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JULY 1960
VOL. 2 NO. 7

Journal of Occupational Medicine

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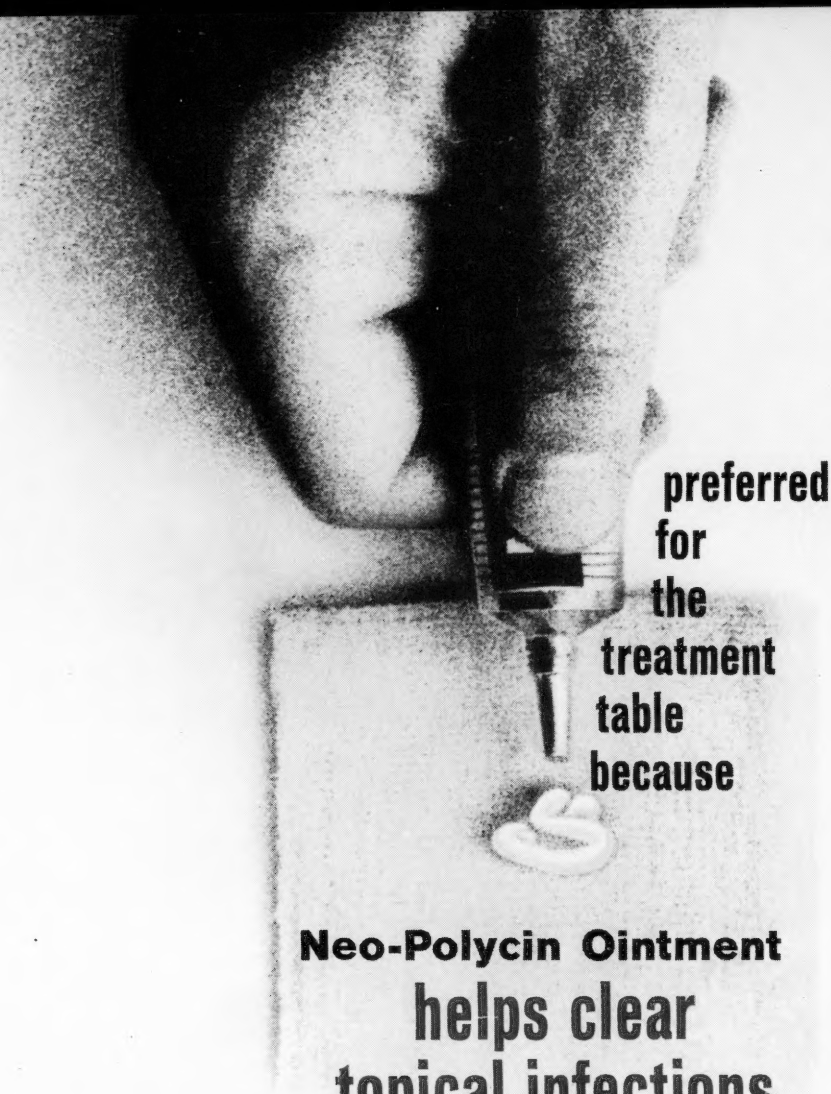

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Journal of Occupational Medicine is published by the Industrial Medical Association, 28 East Jackson Boulevard, Chicago 4, on the 1st of each month. Second class postage paid at Chicago, Illinois. Copyright 1960 by the Industrial Medical Association. Title registered, United States Patent Office.

Subscriptions $10.00 per year—U. S. and foreign. Single copies $1.00 postpaid. Make checks payable to Journal of Occupational Medicine.

Subscriptions, changes of address, and all business matters should be addressed to Clark D. Bridges, Publication Manager, Journal of Occupational Medicine, 28 East Jackson Boulevard, Chicago, 4, Ill. Eastern Advertising Representative: Mrs. Virginia Page, 15 West 44th St., New York 36, N. Y. Telephone: Murray Hill 7-7040.

Manuscripts submitted for publication should be sent direct to the Editor, Adolph G. Kammer, M.D., 2057 Beechwood Boulevard, Pittsburgh 17, Pennsylvania.

Change of address notices received by the 15th of any month will assure delivery of the following month's issue. Address change is facilitated if old address is also furnished.

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The Industrial Medical Association was organized in 1915 as the American Association of Industrial Physicians and Surgeons. Its first annual meeting was held the following year. In 1951 the present name was adopted.

The purposes of the organization as stated in the certificate of incorporation (not-for-profit) are:

"The object of this Association will be to foster the study and discussion of the problems peculiar to industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes of the medical care for employees; and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for their mutual advancement in the practice of their profession."

Presently, the membership includes more than 4000 physicians in the United States, Canada, Latin America, and other parts of the world. Physicians "who have an interest in Industrial Medicine" may apply for membership; specialization in this field is not essential. Regionally, the Industrial Medicine Association has 15 Component Societies in the United States. Most Association members carry their membership through one of the component groups.

The Journal of Occupational Medicine, owned and published by the Industrial Medical Association, is sent monthly to each member as one of the advantages of membership.

The annual business meeting and convention is held in the spring. Since 1945, the convention has been held concurrently with the meetings of four other organizations having related interests—American Industrial Hygiene Association, American Conference of Governmental Industrial Hygienists, American Association of Industrial Nurses, Inc., American Association of Industrial Dentists. This combined meeting is known as the Industrial Health Conference.

The Occupational Health Institute, Inc., is a non-profit educational organization created by the Industrial Medical Association to promote the cause of health in industry. Since 1951, the Occupational Health Institute has conducted the program of evaluation, approval and certification of Medical Services in Industry, on the basis of standards established by the Standards Committee of the Industrial Medical Association. This program was conducted by the American College of Surgeons for many years until its transfer to the Association.

The Association's headquarters office serves as a focal point for the Association's activities and through its coordination of information regarding industrial health problems encountered throughout the country, it offers invaluable assistance to members on a host of specific subjects.

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An important function of the District Counselor is to serve in a liaison capacity with the Component Society of the Industrial Medical Association in his area. The District Counselor also is concerned with regional trends in industrial medical practice and in legislation bearing upon medical service in industry. He is ready to assist any physician with questions or problems.

In promoting the cause of industrial medicine, many District Counselors work with the industrial health committees of their state medical societies, they participate in teaching programs at hospitals or medical schools, and serve as speakers at meetings of groups that express interest in occupational health. Throughout these activities, the District Counselor attempts to stimulate membership in the Industrial Medical Association by acquainting others with the organization's purposes and facilities.

By keeping in close contact with members in his area, the District Counselor gains a familiarity with their work which enables him to make recommendations to the Association's officers and committees regarding those qualified for various positions or honors. He recommends members for committee work, and for fellowship, and recommends fellows for consideration for elective offices in the Association. He also recommends possible recipients for the awards presented at the annual meeting of the Association—the Knudsen Award, the Health Achievement in Industry Award, the Meritorious Service Award and the Merit in Authorship Award.

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Association Activities

Criteria Governing the Establishment of Component Societies of the Industrial Medical Association

Adopted by the Board of Directors, February 10, 1960

SECTION 1—The Board of Directors may establish Component Societies upon application of not less than 25 industrial physicians and/or surgeons residing or practicing in any geographical area who present acceptable qualifications for membership in the Industrial Medical Association. Such application is to be submitted to the Board of Directors through a District Counselor serving the geographical area under consideration.

SECTION 2—The boundaries of Component Societies may be changed and new boundaries established by the Board of Directors of the Industrial Medical Association after consultation with the Component Society or Societies concerned.

SECTION 3—A Component Society shall adopt By-Laws and Regulations for government of its own business and affairs which are not in conflict with those of the Industrial Medical Association. When applying for Component Society status in the Industrial Medical Association the proposed By-Laws or Regulations for that group shall accompany their application.

SECTION 4—When a Component Society has been established, all existing members or Fellows of the Industrial Medical Association residing or practicing within the geographical area involved shall automatically become members of said Component Society.

SECTION 5—Only in unusual circumstances will industrial physicians or surgeons residing or practicing in a geographical area covered by a Component Society be allowed to retain a direct membership in the Industrial Medical Association and this will be only with the recommendation of the District Counselor and approval of the Board of Directors of the Industrial Medical Association.

SECTION 6—Non-member industrial physicians and/or surgeons residing or practicing in a geographical area of a Component Society shall apply and be considered for membership in the Industrial Medical Association only through and upon the recommendation of the Component Society and District Counselor of the Association.

SECTION 7—Members of a Component Society may be elevated to Fellowship in this Association only as provided in Article III, Section 2 of the By-Laws of the Industrial Medical Association.

SECTION 8—Each Component Society shall hold an annual meeting at which time a President, Secretary, and/or Treasurer, and Board of Governors or Directors shall be elected by ballot. Other officers may be elected in accordance with the needs of the Society and additional meetings may be held if deemed advisable.

SECTION 9—The Secretary of the Component Society shall maintain liaison with the Managing Director of this Association and shall keep the Association informed of those elected as officers and Directors or Governors. He shall also maintain an accurate membership roster and he or the Treasurer shall collect dues from members of the Component Society and remit to this Association that portion of dues as is provided for in Article XI, Section 1 of the By-Laws of the Industrial Medical Association. The dues year for members of Component Societies shall be consistent with the dues year of the Industrial Medical Association.

SECTION 10—By mutual agreement between the Component Society and the Managing Director of the Industrial Medical Association, dues may be collected by the Industrial Medical Association and that portion due the Component Society remitted to the Component Society. (This method is recommended in order to simplify and expediate the overall dues collection problem.)

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Journal of Occupational Medicine

INDUSTRIAL HEALTH EDUCATION

Education for Industrial (Occupational) Medical Practice

William F. Ashe, M.D., Columbus, Ohio

CONTRARY to the usual procedure for the publication of articles and essays in United States medical journals, the author was commissioned by his peers to write this bit. For that reason it is being written in the first person. It reflects my observations and my opinions. The errors are mine. Blame not the very fine editorial staff of this JOURNAL for any of it, nor assume that anything I say reflects their opinions.

Twelve years ago it was my privilege to be intimately associated with the first formal training programs in industrial medicine in the United States, to help to outline the principal educational tasks of this field of medicine, and to attempt to predict the future. Now, in 1960, to have the honor to review the good and the bad of this 12 years of educational effort and experience, to acquaint the world with what the United States and Canada have done and are now doing in industrial medicine education, and to suggest guide lines for the future is indeed a pleasant task.

In 1948 industrial medicine was defined as "medicine in industry"[1] and its main purposes were outlined by Dr. Robert A. Kehoe as follows:

1. To promote the health of industrial workers.
2. To reduce the economic losses of wage earners and employers occasioned by physical inefficiency, sickness and injury.
3. To study the basic environmental conditions of industrial employment and the reactions of workmen thereto so as to reduce occupational handicaps and hazards and to place individual workmen in the most suitable job.[1]

Certain additional points of view were expressed by me in 1948 which may be worth repeating for purposes of obtaining perspective.

"For the past few years nearly every union contract written, of which there are thousands written annually, contains some sort of health clause requiring the provision by management of health service in some form. This demand has occurred so suddenly and on such a scale that the medical profession is caught flat-footed, wholly unable to meet the demand. America has seen a need for a type of medicine which the profession itself failed in large measure to anticipate.

"Medicine in industry is no longer limited to medicine per se. It is a varied and extensive service requiring an industrial physician who has had undergraduate and postgraduate training in this type of medicine and has served an in-plant internship and/or a year or two of apprenticeship in industry. He needs a fundamental knowledge of industrial hygiene, toxicology and human relations in addition to excellent training in medicine and some back-

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ground in surgery and psychiatry. He is a specialist whose training must encompass a much broader scope than that required of the internist or the surgeon.

"Obviously, until medical education can rearrange itself to provide such specialists, physicians self-educated in matters of industrial health must attempt to satisfy the present need.

"Concomitantly, engineers inadequately trained in the techniques of environmental survey and control must educate themselves to meet the present demand until, by a combined effort, the engineering and medical colleges can supply adequately trained industrial hygiene engineers.

"Schools of public health are likewise deficient in preparing our local, state, and federal public health officers to administer the laws providing for the maintenance of health among working people.

"While these three groups of educators are admittedly at fault in their failure to anticipate and meet the present enormous need for skilled specialists in this field, none of them is indifferent to it."[1]

In 1948 at least nine medical colleges were actively engaged in plans to develop graduate education in industrial medicine, and many others were enlarging their undergraduate programs. The schools of public health began to broaden their programs, and several of the engineering colleges were studying methods by which they might hold up their end of the load.

In the medical field, at least four commendable trends were apparent.

1. A few large and farsighted industries were attempting to develop adequate in-plant training for their industrial doctors.

2. Two formalized postgraduate educational programs leading to advanced degrees in this field had come into being in 1947.*

3. To help the physician educate himself to meet the immediate situation, several medical colleges began to provide postgraduate courses for a few weeks each year. The leading men in the field gave unstintingly of their time and knowledge to help to make these courses thoroughly worthwhile.

4. The Council on Industrial Health of the American Medical Association began to prod medical educators to improve undergraduate teaching in industrial medicine. The big difficulty then and now lies in the fact that medical curricula are already overburdened. I believe that the secret of success will lie not alone in increasing the hours spent on industrial medicine per se but rather in infiltrating all courses from anatomy on up through the clinical years with more and more examples and illustrative material from industrial medical practice.

The Council on Industrial Health, working jointly with the Council on Medical Education and Hospitals, also began to consider the development of some sort of a residency system in this field comparable to residencies in medicine and surgery. Dr. Kehoe and I both strongly urged them to bear in mind that the place to learn medicine is at the bedside, the place to learn surgery is in the operating room, but the place to learn industrial medicine is in the factory. In 1948 the American Medical Association had not yet reoriented its thinking so that it could recognize selected industrial medical departments for special training, just as it recognized selected hospitals.

In attempting to look into the future of that period, I ventured to suggest: "Whatever the shape of things to come may be, it is quite apparent that all of us have to develop a new perspective. Industrial medical practice is not the business of wrapping up cut fingers and opening boils. In fact, in the not too distant future, we may measure the extent to which the industrial physician fails successfully to perform his tasks by the number of occupational diseases and accidents which he is called upon to treat. The task of industrial medicine is to foster health and prevent disease. Furthermore, we must begin to see that the economic aspects of the coveted 'doctor-patient relationship' can and often must be wholly independent of that relationship. No matter by whom the physician is paid he is obligated to maintain his professional integrity and to give only sound advice based upon an honest and sincere regard for the health of the persons for whom he is responsible. Certainly, unless he is willing, he need not be the hired servant of management or the partisan of the labor organization. Indeed, the better his training, competence, and judgment, the more independent he will be in his professional capacity. His professional conduct must be unassailable by the individual patient, by organized labor, or by management. To establish and maintain such a position he must have an intimate knowledge of the industry in which the personnel for whose health he is responsible are employed —this in addition to an intimate knowledge of the people and the disease which he attempts to prevent or is forced to treat. Obviously such a task cannot be accomplished by any part-time

*For detailed outline of curricular content and the reasons for each inclusion see Ashe, W. F.[2]

practitioner whose primary concern is private practice. Most practitioners cannot even hope to treat occupational disease intelligently because correct diagnosis and successful treatment frequently depend upon an intimate knowledge of the working environment from whence the patient comes.

"Industrial medicine as a legitimate specialty in its own right will be recognized, I sincerely hope, on the merits of its practitioners. Let us prepare ourselves to help it develop rather than put obstacles in its path. Let us learn to recognize its competent practitioners by their abilities and by the fruits of their labors and not complicate the picture of the medical profession by the institution of more and more artificial means of recognition."[1]

Many things have happened in the 12 intervening years.

First of importance is the gradual development of the concept that the ideas and ideals outlined above are applicable not alone to industrial establishments, but to all who are gainfully employed—be they in factories, mercantile shops, tunnels and mines, transportation systems and public utilities, hospitals, municipal government, or university campuses. With a broadened concept, terminology has changed from Industrial Medicine to Occupational Medicine and the definition likewise: "Occupational Medicine is that branch of Medicine which deals with the relationship of man to his occupation, for the purposes of the prevention of disease and injury and the promotion of optimal health, productivity and social adjustments."[4] Today, also, educational terminology has become more formalized and uniform. Medical school is referred to as *undergraduate* medical education. By *graduate* education we mean formal residency and/or fellowship training with or without matriculation in a Graduate School of Arts and Sciences or Public Health. *Postgraduate* education refers to short courses in specialized areas for practitioners of medicine who cannot or do not wish to engage in formal graduate training and for which no credit toward a degree is given. It is part of continuing education in medicine.

The American Board of Preventive Medicine has come into being and the specialty of occupational medicine became officially recognized in 1955. The accredited training programs are of three years' duration. The establishment of a specialty board is a mixed blessing. Its purpose is, of course, to raise the standards of education and practice in the field of occupational medicine. Specialty recognition of occupational medicine has given us status in the eyes of our profession and among recent medical graduates and provided better and better applicants for residency training. This is good. On the other hand, by the very act of definition of acceptable programs, there are automatically exclusions from which come several evils. There tends to be a certain rigidity of approach which may not be good for industry or for the profession. Industry obviously needs men trained in the presently standardized pattern to become medical directors of large companies or groups of small companies. But it also needs and cannot readily get, through this accrediting system, a very considerable number of highly competent clinicians with only a year or less of indoctrination in the principles of the application of preventive clinical medicine to working populations. It needs good internists with a new point of view. At present, young men married and with families, 32 or more years of age, will rarely take an extra year of industrial medicine after three or more years of internal medicine and the American Board of Preventive Medicine will not always recognize them if they do. Their position is further complicated because the American Board of Internal Medicine is frowning on certifying qualified internists who work full time in industry, since such men have no hospital therapeutic experience. Both groups are being unwise and more concerned with their own pristine purity than with the medical needs of the nation they serve. This is bad. Also, at the moment, there does not exist through either the American Board of Preventive Medicine or the American College of Preventive Medicine any continuing education procedure which will permit the untrained practitioner to learn as he works* and ultimately achieve status as a first-class citizen. This too is bad. A wholly flexible system, contained within the framework of university graduate schools whose product is judged on the old Biblical adage, "By their fruit ye shall know them," might be better. I submit that no board diploma or certificate in any specialty insures a truly good practitioner nor one who can change easily with the demands of a changing social milieu.

*A start has now been made in this direction. The American Academy of Occupational Medicine, in conjunction with the School of Public Health and Medical Administration of Columbia University offers a program of home study and intensive class review designed to help qualified candidates prepare themselves for the Board's examination. *(Editor's Note: For further information regarding this course, see the data carried in a box on page 287 of the June, 1960, issue of this Journal.)*

The 1959 issue of the *Journal of the American Medical Association* listing Approved Internships and Residencies[1] reveals that six of the nine university medical schools which were thinking about occupational medical programs in 1948, are now approved, fully or conditionally, for three-year training programs in the specialty. They are:

1. University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pa.
2. University of Cincinnati Institute of Industrial Health, Cincinnati, Ohio.
3. University of Rochester School of Medicine and Dentistry, Rochester, N.Y.
4. Yale University Department of Public Health, New Haven, Conn.
5. University of Michigan Institute of Industrial Health, Ann Arbor, Mich.
6. The Ohio State University Health Center, Department of Preventive Medicine, Columbus, Ohio.

All six are graduate residency and/or fellowship programs which train physicians for the specialty of occupational medicine. In addition, four of these also train industrial hygiene engineers and two train industrial nurses. To date these six training centers have graduated 148 physicians,* 89 industrial hygienists, and 18 nurses. Of the 148 physicians, 108 are in full-time practice in industry, 5 in academic medicine in the United States, 11 in teaching positions abroad, 22 in governmental positions in 16 countries, and 2 in miscellaneous occupations which include part-time practice in industry. No satisfactory data on the distribution of industrial hygienists was obtained. Of the nurses, 2 are full-time in academic nursing, 2 are in government work, and 14 are in practice in industry.

Three of these schools offer a one-year training program in public health with major emphasis on industrial medicine. One other offers a single year in industrial medicine not in a public health curriculum. The short programs are largely filled with foreign students. The countries of origin of graduates of these programs include:

Peru	Argentina
Philippines	Norway
Chile	Venezuela
Japan	Colombia
Egypt	Israel
Switzerland	Taiwan
Austria	Germany
Mexico	

*Slightly more than half have completed three-year programs. The others have, for the most part, had only one year in conjunction with training in public health.

The six schools have, in addition to their graduates, 48 doctors, 18 hygienists, and 3 nurses now in training. All could take more students of excellent quality, but none is, nor should be, interested in turning out numbers of mediocre or poor students. One very pressing problem is that there are not enough good applicants for training.

It is terribly important that some of the cream of any educational crop stay on in teaching and research capacities if our programs are to continue and to improve. We are not replacing our teachers fast enough in the United States, but we are training a good percentage of academicians of other countries.

The curricular content of these programs is not completely uniform as to terminology or degree of emphasis on various phases of the work—nor should it be. Yet each covers certain fundamentals essential to the effective practice of occupational medicine. These fundamentals were originally determined by a critical analysis of the duties and responsibilities of more than 30 full-time medical directors of large corporations covering most of the major industries of this country. An effort was made to define what such men needed to know to do their jobs most effectively. With experience and with consultation between educators and practitioners, these requirements have been refined somewhat and, to a degree, were added to when occupational medicine became a part of the American Board of Preventive Medicine.

Properly, such a graduate curriculum should be made up of three major areas: basic science, in-plant clinical practice, and research.

Under basic science are included:

(*a*) Environmental physiology
(*b*) Industrial toxicology
(*c*) Introduction to business management
(*d*) Principles of safety engineering
(*e*) Basic principles of workmen's compensation law
(*f*) Statistics and records systems
(*g*) Principles of industrial hygiene (measurement of environmental hazards)
(*h*) Principles of environmental control
(*i*) Principles of public health
(*j*) Industrial injury pathology
(*k*) Psychological and psychiatric interview techniques

Some direct industrial exposure during the first two years serves to familiarize the student with each phase of the practice of occupational medicine and industrial hygiene, and is augmented by hospital and out-patient clinic experience in any area where the individual is

found to be weak. Only in the third, or in-plant, year does he have day-to-day experience with all phases of the work. (See subsequent article: "Graduate Training in Occupational Medicine—The Inplant Component" by Paul J. Whitaker, M.D.)

It is my feeling, concurred in by a majority of my colleagues in the field, that no graduate degree program has an excuse for existence unless it insists that its students actively participate in scientific research. The purpose is more to teach the methodology of scientific investigation, to teach a critical approach and to instill an interest in understanding the unknown, than to achieve results.

In the majority of instances the research work being done by graduate students in the accredited training schools is at the level generally considered consistent with master of science degrees. The variety of degrees given is by no means standardized. In a few rare instances the nature and quality of work done merits a Doctor of Philosophy degree or equivalent.*

"Industrial Medicine" appears as a course title in the curricula of a majority of schools of public health, but in them the purpose is to acquaint public health officers with our field rather than to train practitioners, teachers, and investigators. However, Columbia, Johns Hopkins and California have each trained occasional specialists for the practice of occupational medicine without bothering to go through the usual accrediting procedure. Harvard School of Public Health has trained a considerable number of excellent men in industrial hygiene, and specialization in either industrial medicine or aviation medicine within the framework of a doctorate in public health has been possible for some years.

Most of the accredited schools periodically provide postgraduate educational programs of short duration for men already in practice. This is also done by Wayne University, the University of California at Berkeley, and New York University. The latter course, of two-months' duration, is the most extensive of its kind and serves a very useful purpose for both U.S. and foreign professional persons interested in occupational medicine. In addition, the American Academy of General Practice includes a section of industrial medicine in most of its annual meetings as does the Interstate Postgraduate Seminar. The American Medical Association also sponsors an Annual Congress on Industrial Medicine, as do a few state and county medical societies.

*For additional information see Kammer, A. G.[5]

American industry has absorbed physicians, both trained and untrained, as fast as they have become available and the demand still far exceeds the supply. Many industries, able to attract or desirous of only untrained men, have intramural training programs of their own.

In general, the status of the physician in industry has been significantly upgraded in the last 12 years and the salaries and fringe benefits paid these men make their profession economically competitive with the private practice of medicine.

None the less, the vast bulk of American small industry still has either no medical service or inadequate medical service. The reasons are many: Industries employing less than 750 persons and particularly those employing less than 100 persons cannot afford full-time in-plant medical service, and the part-time services available to them usually include only preplacement physical examination and repair of injuries with no effort being made to control the working environment so as to prevent illness or injury. The general practitioners who serve them on a part-time or on-call basis know little or nothing about what goes on in the plant and are ill-prepared to function effectively in any preventive sense. Many industries which provide full-time nursing service, part-time medical service and periodic-industrial hygiene service think they cannot afford a full-time doctor or hygiene engineer when, in fact, they are losing money excessively through absenteeism and workmen's compensation because of lack of these services. Finally, there is at present no effective means of communication between industrial management (especially of small industry) and the medical profession. The golf course locker room and the P.T.A. are too often their only common meeting grounds and in neither place does the profession feel free to sell its services. The ethical code of our profession needs careful scrutiny in this area. (Why, for example, is it proper for the directors of any of the six accredited schools to pound the desk and tell the board of directors of a big industry that they are negligent in providing for medical services and demand that they mend their ways, while it is very definitely improper for a private practitioner of industrial medicine to advertise his services in his community through letters to plant managers?)

One of the very fine developments of the past 12 years is the development of in-plant resident training as part of the graduate education in occupational medicine. This subject is being covered in detail in another article, but it is

proper to emphasize here that this loose, working arrangement between the university and the industrial medical department has been and will continue to be highly beneficial to both. It will remain effective, however, only if the universities retain supervision of the training content of such programs. In all specialties, when education has been taken out of the hands of educators, the quality of the product has deteriorated.

Now let us take a critical look at the men being produced and industry's need. How well are we doing the job? What changes need to be made in the next few years?

I think that experience has proved beyond reasonable doubt that the product being turned out by our accredited graduate schools is excellently trained to direct the activities of the medical departments of large industry. Yet if one asks the present medical directors of some of these companies searching questions, the answers are surprising and often conflicting. For example, suppose I say to a friend, "Doctor, you need to fill three positions in your company —what sort of men will you try to get?" He often says, "Well, for the reduction plant I need a young well-trained surgeon whom I can interest in handling our large minor surgical load. I can teach him prevention. In the home office I need an internist to do periodic health appraisals, and in the sales force I need only private clinics to which I can send men annually and as the need arises." "But Doctor," say I, "how about some of the new Board-eligible graduates from schools of occupational medicine? Don't you really want one of them?" Answer, "No, I don't. Every good-sized outfit needs one or two of those men. They are good, but a lot of our jobs don't need men with that much training. Many of our fabrication plants wouldn't be any challenge to them and what we need right now is more Indians and less chiefs." Or from the medical director of a chemical company which has a dozen or so small plants hiring from 150 to 500 men, "Hell, Bill, how could I use one of these 'hot shots.' Sure I'd like to have them in every plant, but it isn't economically feasible and they wouldn't have nearly enough to do. Furthermore, I've never seen one of them who would be willing to be a circuit rider and cover several states for us. Even if he would, I'd still have to have a local general practitioner covering emergencies." One gets the very definite impression that if the medical directors of such corporations as U. S. Steel, or Standard Oil (New Jersey) or du Pont (these are but examples of companies with excellent medical programs in fact or in the making) could get all the trained occupational medicine specialists they want and could pay them well, they still would not choose these men for *all* of the positions available. On the other hand, personal experience in many lands convinces me that our foreign colleagues want all they can get of the type of product we are turning out.

From these facts and from an analysis of the supply and demand problem, I gather that we are not training enough specialists in occupational medicine yet. All who are trained are easily placed. They fit readily into the industrial team and contribute much to the welfare and productivity of employer and employee. Industry also wants a very considerable number of doctors with types of training and experience which are quite different from that provided by our specialty schools and as prescribed for by our American Board of Preventive Medicine (Occupational Medicine). These are obtained from general practice and other specialties. Their main defect lies in their lack of conviction that the primary job is prevention.

In one very major industry, aviation, a ludicrous situation exists. There are two kinds of certified specialists, neither of whom has found a very firm place in the industry. Occupational medicine (or industrial medicine) and aviation medicine, on the surface at least, both should be needed in airframe manufacturing, by the transport airline, by the air-freight companies, and by the commercial crop dusters. Curiously, only 6 of more than 50 commercial transport aviation firms have full-time medical directors, and, while some of these are Board-accredited under the "grand-daddy" clause, perhaps one has had the training and background needed to fit him for his whole job. Everyone seems afraid to admit that, call it what you may, occupational medicine and aviation medicine are both the study of man in the environment of his work and the control of that environment for the purpose of the promotion of health, safety, and optimum productivity. One airframe manufacturer has a superb medical department which studies pilots and passengers in altitude chambers, and he says, "We have no aviation medical department. We just do industrial medicine." In another in the same city, one man does what he calls aviation medicine and another does the industrial medicine, and their paths rarely cross. I agree with a French colleague who discussed this problem with me some months ago and, shaking his head sadly, said, "Americans, very droll."

The number of men who actively participate in the programs of both the Aerospace Medical Association and the Industrial Medical Asso-

ciation probably can be counted on two hands. Yet the basic principles of what each is dedicated to do are identical. The same applies to what is now called nuclear medicine, to space medicine, and to submarine medicine. To my mind they are one and the same and can be taught under one curriculum. Train a man to recognize and to deal effectively with any environmental hazard associated with man's work, and you will fit him for effective function in any of these so-called specialties. They are not public health as presently taught and practiced, but they are preventive medicine. The convenient merger of public health, occupational medicine, and aviation medicine under one Board of Preventive Medicine and under a College of Preventive Medicine requires that we solve these problems both in education and in practice. We must also solve the problem of industry's need for various kinds of doctors or learn to cooperate with other areas of specialization to supply industry with the men it needs. Finally, we must educate our fellow M.D.'s in private practice to their responsibilities toward American industry. After all, our standard of living as American physicians (among the highest in the land) stems more from American industry than from our own professional skills.

Humility and wisdom we badly need. Youngsters rarely have it. We of the specialty of occupational medicine are very young and no exception to the rule. Yet, in only 12 years, we have come a creditable distance. I am less able to see the specifics of the future than in 1948, but I am sure medicine will mean more to industry and industry will mean more to medicine in 1972 than either means to the other now. It is likely that the factory will become the clinical laboratory for studying the natural history of malignant and degenerative disease. (Won't it be fun if this is in spite of, rather than because of, our system of specialists?)

As organized labor in this country pushes more and more for cradle-to-grave medical care for all employees and their families, we may find ourselves needing to take another look at the type or types of medicine which should be practiced in an industry-financed plant medical department. One large employer I know has already found that he could save money by building a hospital and paying for a complete clinic staff. Be this as it may, of the following I am sure: The preventive aspects of occupational medicine must be practiced and will be practiced only by specialists in the field.

Summary

Occupational medicine is defined as the study of man and the environment of his work and the control of that environment for the purpose of health, safety, and optimum productivity. Certain noteworthy things have happened in the 12 years that have elapsed since we began to apply ourselves seriously to the preparation of physicians for this special practice. These include a broadening of concepts from those implied in the earlier term, industrial medicine; formal graduate training of physicians; and a formal mechanism of certification. The structure of the training programs emerged from a study of the needs and opportunities of industrial practitioners, with elaborations being made to suit changing circumstances. Facilities are needed that will permit and encourage self-preparation of practitioners for the examination in occupational medicine given by the American Board of Preventive Medicine. The services of fully trained specialists, in large corporations at least, must as a practical matter be augmented by the work of physicians who are partially trained or whose basic interest is in some field other than this specialty.

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Graduate Training in Occupational Medicine —The In-Plant Component

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TRADITIONALLY, the final year of a graduate specialty training program offers the resident an opportunity to become proficient in the application of those skills and special techniques he has learned in the previous years of his residency. Because the hospital generally offers the resident his greatest opportunity to develop these special skills under proper supervision, the hospital has until recently been the site of resident training programs.

Prior to 1947, no recognized program of training for industrial medical practice existed in the United States. Physicians entering this type of practice were recruited by industry from internship or from practice without benefit of formal training, and they learned by doing. Exchange of information and experiences at national and international meetings and the publication of scientific articles in a limited number of journals afforded these pioneers in industrial medicine their only educational opportunities.

With the establishment of educational programs in occupational medicine in 1947, it became apparent that some change in the established format of graduate training would be necessary. The founders of these first graduate training programs at the University of Pittsburgh and the University of Cincinnati were dedicated to the principle that a medical specialty must be learned where it is practiced. In addition, the general hospital, at least in the United States, had so few opportunities for teaching in preventive and occupational medicine that some other source of teaching material had to be located. Established occupational health programs in certain industries even then represented untapped opportunities for complementing the training that could be offered at the university. Accordingly, a few selected industries were requested by these university centers to establish in-plant residency training programs, and in 1949 the first such residency was established by an affiliation between the University of Cincinnati and the Medical Department of the Caterpillar Tractor Company at Peoria, Ill. In the immediately ensuing years, similar programs were developed in certain other industrial organizations, including Eastman Kodak Company, Merck and Company, Inc., E. I. du Pont de Nemours & Co., Inc., and the Texas Company. These one-year in-plant programs, together with the two-year academic programs established at the universities, set the pattern for the programs for training physicians which developed with the accreditation of the specialty of occupational medicine in 1955.

The 1954 Report of the Committee on Education and Certification of the American Academy of Occupational Medicine defined the purpose of in-plant training and established a minimum curriculum for such programs as follows:

> The physician trainee needs an opportunity to develop himself, within a setting representative of that in which he will carry on his chosen profession. Through performance rather than instruction, the post-academic year is meant to stimulate in the student:
>
> A. A familiarity with the techniques of the clinical, laboratory, and statistical sciences as these are applied in a program of preventive medicine in an employed population.
>
> B. An appreciation of the art of clinical practice in the non-traditional situation in which the physician is not specifically chosen by those whom he serves.
>
> C. A discernment of the relative importance of health problems.
>
> D. An understanding of the workmen's compensation laws and the industrial physicians' responsibilities therein.
>
> E. A comprehension of the need for teamwork in rehabilitation of the handicapped, whether the handicap be medical or surgical, occupational or non-occupational.

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F. A recognition of the fact that the concern of the physician is the study and understanding of man and not merely of disease.

In 1955, the American Board of Preventive Medicine began certifying a founders group in occupational medicine. Since other candidates for certification would be eligible only through examination and since eligibility for examination required completion of approved training, it became urgent that some method of approving in-plant training programs be adopted.

The Council on Medical Education and Hospitals of the American Medical Association had for years examined and approved the residency training programs in the United States necessary for the training of physicians in the various recognized specialties. Since one requirement of the American Board of Preventive Medicine was the successful completion of one year of an in-plant residency, the American Medical Association, through its Council, was faced with the necessity of approving residencies for which no minimum standards had been established and of examining residency programs in industrial organizations with which no lines of communication existed. This was a unique experience in the history of specialty board certification and required the establishment of procedures differing somewhat from those previously used.

Accordingly, in 1957, the Residency Review Committee in Occupational Medicine, composed of representatives of the Board and the Council, requested the Academy to provide minimal standards for in-plant residency programs and to assist the Board further by surveying, in collaboration with the inspection staff of the Council, the training programs in industrial organizations. The Academy agreed to cooperate fully in this activity, and assigned the requested function to its Standards Committee.

In July, 1958, the Standards Committee completed the recommended minimum standards for in-plant programs based in part on the earlier report, and these were made available to the Residency Review Committee. The Council then created a questionnaire-type of application form based on these recommendations, and the evaluation of in-plant programs got under way.

The standards recommended and now in effect are the following:

1. *Training Location*—The residency is ordinarily an integral activity of the medical department of an industrial organization. Residencies within governmental agencies or organizations serving industry may be approved provided all minimum standards are met. A joint residency involving two organizations may also be approved provided all minimum standards are met. This cooperative effort might involve an industrial organization and a governmental agency and might prove useful to industrial organizations with limited environmental hygiene programs.

2. *Medical Policy and Procedures*—The organization shall have a medical policy based on fundamentals of preventive medicine. The procedures utilized to implement this policy shall be based on sound preventive medical practices and conform to those outlined in "Scope, Objectives, and Functions of Occupational Health Programs" as published by the Council on Industrial Health of the American Medical Association,[1] as well as the "Statement of Objectives, Scope, and Accepted Methods" as viewed by the American Academy of Occupational Medicine.

3. *Medical Department*—The medical department shall be of sufficient size, properly equipped, and adequately staffed to carry out the stated policy. Minimum facilities for the performance of thorough physical examinations shall be located within the department. A properly equipped and staffed dispensary for emergency medical and surgical care shall be maintained. Adequate and confidential medical records shall be maintained.

4. *Medical Staff*—The professional staff shall be composed of graduates of approved professional schools, properly licensed to practice their respective professions. All shall conform to their respective codes of professional ethics. The medical director or chief officer shall be a diplomate of the American Board of Preventive Medicine. Physicians and nurses shall be well informed on the preventive approach to occupational medicine. A competent consulting staff shall be maintained.

The resident shall be a member of the medical staff compensated at a rate commensurate with his contributions. He shall have ample ooportunity to observe and treat, under supervision, medical and surgical emergencies and minor surgical cases. He shall perform physical examinations of all the types normally performed in the department. He shall receive regularly scheduled instruction under the direction of the medical director or chief medical officer on all medical department functions.

5. *Educational Opportunities*—The medical department shall have a stated policy of providing regularly scheduled opportunities for the resident to observe and participate in the following activities:

A. Industrial Medical Practice (40% to 60%)
  1. Prevention
    (a) Environmental Hygiene
      1. Physical
      2. Chemical
      3. Infectious disease control
    (b) Clinical Examinations
      1. Routine: Pre-employment; Periodic; Post absence; Retirement.
      2. Special: Hazard; Transfer; Disability evaluation; Case finding; Miscellaneous.
    (c) Early Case Finding by Survey Methods
    (d) Health Education
      1. Nutrition and diet

2. Habits of work, exercise, recreation, rest
(e) Mental Health
(f) Participation in Accident Prevention Program
(g) Participation in First Aid Training
(h) Supervision of First Aid Stations
(i) Emergency and Disaster Planning
(j) Medical Department Record System

2. Treatment
(a) Minor Surgical
(b) Minor Medical
(c) Minor Psychiatric
(d) Physiomedical

3. Rehabilitation
(a) Medical
(b) Surgical
(c) Psychiatric
(d) Vocational
(e) Social

4. Professional Relationships, Consultations
(a) Within the department
(b) With the private practitioner
(c) With the health agencies

5. Workmen's compensation and other type of insurance relating to occupational medicine

B. Operations (20% to 40%)

1. Materials flow
(a) Raw materials
(b) Processes
(c) Products
(d) By-products
(e) Wastes

2. Industrial Hygiene—field and laboratory experience
(a) Types of surveys
(b) Sampling and analytical techniques—their uses and limitations
(c) Methods for control of environmental hazards

3. Plant Safety
(a) Personal protection
(b) Mechanical methods for individual protection
(c) Engineering methods for group protection
(d) Education

4. Sanitation: Services and Facilities
(a) Waste Disposal
(b) Atmospheric Pollution
(c) Stream Pollution
(d) Feeding Establishments

C. Administration (10% to 20%)

1. General Business Policies and Practices of of the Company
2. Industrial Relations Policies and Practices
3. Medical Department Policies and Practices

D. Research (0% to 10%)

The organization shall evidence, through practice, a sincere desire to offer educational opportunities to the resident physician. The amount of time spent in the medical department by the resident on the performance of routine medical matters shall in no instance exceed 60% of the year.

By June, 1959, a sufficient number of applications had been received and processed to initiate an inspection program. These inspections were made by members of the Standards Committee of the Academy. The inspector was provided with a copy of the application form, and it was his duty to verify the correctness of the information submitted, ascertain the willingness of the organization to provide actual supervised training, and recommend approval or disapproval of the program. His report, forwarded through the appropriate Academy officers to the Residency Review Committee, became the basis for final action by the Council on Medical Education and Hospitals.

As of Jan. 1, 1960, programs at the following locations had been approved for resident training in Occupational Medicine:

Caterpillar Tractor Company, Peoria, Ill.
Westinghouse Bettis Atomic Power Division, Pittsburgh, Pa.
General Motors Corporation, Detroit, Mich.
Division of Industrial Hygiene, New York State Department of Labor, New York.
United States Army Environmental Health Laboratory, Aberdeen Ordnance, Md.
National Lead Company of Ohio, Cincinnati.
Headquarters Air Materiel Command, Wright-Patterson Air Force Base, Ohio.
Eastman Kodak Company, Rochester, N. Y.
Allis-Chalmers Manufacturing Company, West Allis, Wis.
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
Ford Motor Company, Dearborn, Mich.
Pennsylvania Department of Health, Division of Occupational Health, Harrisburg, Pa.
General Electric Hanford Atomic Products Operation, Richland, Wash.

At this writing, the number of approved in-plant residencies is adequate for the number of applicants completing the two years of academic study at a university center. Only time and experience will reveal whether this number will remain adequate for future years.

Summary

The events leading to the establishment of accepted procedures for inspecting and approving in-plant training programs in occupational medicine have been reviewed. Minimum standards for approval by the Residency Review Committee are included. A listing of approved in-plant training programs is furnished.

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Reference

1. Report of the Council on Industrial Health, Scope, Objectives, and Functions of Occupational Health Programs, *J.A.M.A.* 164:1104, 1957.

The Teaching of Occupational Medicine in the United States and Canada, 1960

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A PERIODIC review of the state of the academic nation as it relates to the teaching of occupational medicine illuminates the progress being made. In these curriculum-packed days, thoughts of enlarging the instructional content in America's schools of medicine are short-lived. However, with the continued broadening of industry's influence and its physical plants and populations, a second look at the time given to the medicine of industry is in order. In 1954, in reply to questionnaires, information was forwarded from medical schools in the United States. The results of the survey were presented[1] and now, after six years, the same questionnaire has been sent to the schools of both the United States and Canada. This year, 96 questionnaires were sent, and 79 were returned, a response of 82%. The specific questions and the replies to them, with the figures of 1954 for comparison, follow.

1. Is instruction in occupational medicine included in the undergraduate curriculum?

	Number	Per Cent in 1960	Per Cent in 1954
Yes	70	89	81
No	5	6	17
Planned for	4	5	2
	79	100	100

2. If so, in which department?

	1960	1954
Department of medicine	4	5
Department of preventive medicine and public health	53	21
Department of industrial medicine	1	2
Combinations of these and other departments	12	11

3. How many hours in the sophomore year are allotted to this instruction?

	1960	1954
Total number giving instruction in sophomore year (See Table)	35	18
Average number of instruction hours per school	6.6	9.6

4. How many hours in the junior year are allotted to this instruction?

	1960	1954
Total number giving instruction in junior year (See Table)	39	23
Average number of instruction hours per school	8	9.6

5. How many hours in the senior year are allotted to this instruction?

	1960	1954
Total number giving instruction in senior year (See Table)	32	15
Average number of instruction hours per school	9.3	17.4

Distribution of Hours of Instruction in Occupational Medicine by School Year

No. of Hours of Instruction	Number of Schools Soph. Year	Jr. Year	Sr. Year	All Years
0	34	30	36	....
1	6	1	1	1
2	6	4	2	4
3	2	4	6	6
4	5	2	6	6
5	....	2	1	3
6	5	5	4	5
7	....	2	....	1
8	4	2	....	3
9	1	....	....	1
10	....	4	2	3*
11	....	1	1	4
12	1	5	....	5
13	1	....	....	2
14	....	2	1	4
15	2	....	....	3
16	....	2	1	2
17	....	....	....	1
18	....	1	2	1
19	....	....	....	3
20	....	1	2	....
22	....	....	....	1
23	....	....	....	1
24	....	....	1	1
26	....	1	....	2
27	....	....	....	1
30	2	....	....	1
31	....	....	2	1
32	....	....	....	1
46	....	....	....	3

*For one school, total number of hours only, without breakdown by year.

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6. How many hours in all the school years are allotted to this instruction?

	1960	1954
Total number giving instruction in all school years (See Table)	70	36
Average number of instruction hours per school	12.8	17.7

7. Is the instructor a full-time faculty member?

	Number	Per Cent in 1960	Per Cent in 1954
Yes	29	42	37
No	31	44	63
Both	10	14	....
	70	100	100

8. If the instructors are specialists in occupational medicine, and if they are not full-time faculty members, what are their occupational connections?

	1960	1954
Instructor is full-time in industry	28	8
Instructor is from federal government agency	6	1
Instructor is from state government agency	11	1
Instructor is from city or county government agency	2	3
Instructor is from insurance company	2	1
Instructor is private consultant to industry	6	1
Instructor conducts a medical service for small plants	4	11
Instructor is a private practitioner of medicine and is in industry part time	1	1
Instructor is a private practitioner of medicine and is in a city or county agency part time	1	....
	61	27

9. What is the instructor's academic rank?

	1960	1954
Professor	33	18
Associate professor	20	13
Assistant professor	14	8
Instructor	6	7
Assistant	1	1
Lecturer	18	5
Other	2	1
No appointment	1	....
Not stated	1	....

10. Is the title a clinical appointment, such as Clinical Professor, Associate Clinical Professor?

	1960	1954
Yes	12	8
No	51	27
Both	2	....
Not stated	5	....

11. Are there any other instructors?

	1960	1954
Yes	42	23
No	24	13
Not stated	4	....

12. If so, how many are there?

Number of Additional Instructors	1960	1954
1	5	4
2	14	5
3	4	6
4	7	2
5	2	2
6	2	1
7	2	7
8	2	....
12	1	....
17	1	....
"Varies"	2	....

13. Are the courses elective or mandatory?

	1960	1954
Elective	1	1
Mandatory	62	36
Elective clerkships, but mandatory lectures also	3	1
"No courses mandatory in the curriculum"	1	....
No definitive course, integrated lectures only	1	....
Not stated	2	....

14. What methods of teaching are employed?

Type of Instruction	No. of Schools in 1960	No. of Schools in 1954
a. Didactic lectures	66*	35
b. Field trips	33	20
c. Seminars	24	16
d. Presentation of clinical material	28	15
e. Demonstrations	12	11
f. Laboratory work	2†	6
g. Not stated	1	....

*Didactic lectures were the only method of teaching occupational medicine at 18 schools (10 in 1954). All others combined didactic lectures with one or more of the other methods listed.
†For selected students only, one student.

15. Is any of the instruction given by personnel other than occupational physicians?

Type of Additional Instructor	No. of Schools 1960	No. of Schools 1954
a. Attorney	10	10
b. Chemist	5	8
c. Dermatologist	11	10
d. Employer	1	2
e. Engineer	4	10
f. Health physicist	5	....
g. Industrial commissioner	5	1
h. Industrial hygienist	16	....
i. Insurance representative	5	1
j. Ophthalmologist	2	3
k. Orthopedist	1	4
l. Personnel director	4	2
m. Physiatrist	4	3
n. Professor of social medicine	6	1
o. Psychiatrist	2	4
p. Psychologist	2	4
q. Rehabilitation specialist	10	8
r. Safety engineer	5	11
s. Sanitary engineer	5	....
t. Social worker	7	6
u. Sociologist	1	...
v. Statistician	2	3
w. Surgeon	3	5
x. Union representative	2	4
y. Veterinary scientist	3	1

16. Do any of the (basic preclinical) sciences faculty members participate in the teaching?

	1960	1954
Yes	9	11
No	60	26
Not stated	1	....

17. Are special assignments, such as term papers, plant surveys, or research problems included in the course?

	1960	1954
Yes	8	7
No	60	30
Elective	1	....
Not stated	1	....

18. In what year was the present program started?

Year	No. of Schools in 1960	No. of Schools in 1954
1914	....	1
1934	....	2
1935	....	3
1936	1	1
1938	1	....
1939	3	2
1940	1	1
1942	2	1
1945	4	....
1946	2	4
1947	....	4
1948	3	2
1949	....	3
1950	6	1
1951	....	3
1952	5	2
1953	2	5
1956	8	....
1957	4	....
1958	6	....
1959	6	....
"Gradual"	....	1

19. Is the course of instruction described in the bulletin of your school?

	1960	1954
No	29	20
No	35	30
No separate course	1	....
Not stated	5	....

20. Is there a student health service or an employees' health service within the hospital structure?

	1960	1954
Yes	62	37
No	6	2
Not stated	2	....

21. Is this facility being used for clinical teaching in the occupational medicine program?

	1960	1954
Yes	4	6
No	57	33
Not stated	1	....

22. Are there any features of the instruction in occupational medicine which are unusual, or made possible because of location or other factors?

	1960	1954
Yes	24	12
No	38	21
Not stated	8	....

The affirmative replies to this question were elaborated as follows:

Positive features

1. Demonstrations of pneumoconioses and plumbism.
2. Location.
3. Extensive research facility and staff.
4. Location near industrial plants.
5. Large metropolitan area with considerable industry having medical programs, with Workmen's Compensation Insurance carriers and with Industrial Accident Commission facilities for hearing.
6. Close proximity to treatment facility and rehabilitation program of Workmen's Compensation Board (governmental).
7. Location—State Board of Health is on medical campus.
8. Care of occupationally incurred injuries of University employees.
9. Environmental medicine, with case presentation and field trips.
10. Each year three senior students have opportunity to serve as night interns in the medical departments of private industries.
11. Field trips are conducted.
12. Close proximity to and association with large insurance carrier.
13. Intensive three to three and a half day "in-plant" sessions held in different industries.
14. Courses in occupational health in School of Hygiene open to medical students.
15. Stressing of human factors rather than environmental aspects. Sub-zero temperatures make field trips impracticable.
16. Large industrial facilities available.
17. Field studies in Workmen's Compensation Insurance administration.

Negative features

1. Poor plant and medical environment for such teaching.
2. Rural area with little access to industry.
3. Insufficient hours for course. Poorly scheduled hours and poor attendance.

Four who gave affirmative replies to Question 22 did not elaborate.

Additional Comments of Respondents

As it was in 1954, there was a single feeling threaded throughout many of the completed questionnaires that considerable material was being offered in occupational medicine through integration in ongoing courses in other departments. The discussions of the teaching experiences were worded differently, but the core of the comment is read in the following excerpts.

School No. 12—"Much occupational medicine is taught in the context of other courses—especially in pathology and medicine; some in field work in general social or preventive medicine."

School No. 17—"Clinical teaching, clinical pathology conferences, and grand rounds include full presentation of cases of occupational disease with industrial background. Incidental lectures in other courses add to the total."

School No. 18—"Please don't overlook the fact that there is a lot of occupational medicine not in courses labeled as such: pharmacology—toxicology; internal medicine—wards and clinics; public health—field trips include a plant; epidemiology—lectures include studies of occupational health epidemiology."

School No. 45—". . . in the Department of Rehabilitation Medicine under the guidance of both physicians and social workers, they have some special slant here. Certainly occupational and social factors play a prominent role in the Department of Psychiatry, with whom my own Department works closely. Since all students are exposed at some stage during the third and fourth years to close contact with social workers, this side of occupational health comes up quite often. The specific hazards of working with toxic materials are largely dealt within the Department of Pathology, where the teacher has a specific interest in this area.

"The above explanation might demonstrate that in fact students may obtain experience from a variety of other teaching experiences in this regard."

School No. 49—"Any figures are only approximate, as most teaching of occupational medicine is inextricably meshed with other teaching."

That there is awareness of the need for additional teaching of occupational medicine was indicated by the expressions of other respondents.

School No. 13—"Everyone would like more occupational medicine, faculty and students. The problem is one of finding the time in an already overcrowded curriculum."

School No. 17—"The extent of the undergraduate instruction is not as great as it should be and could be, for the lack of available time. It would be especially advantageous to have greater access to senior and/or junior medical students. The infiltration of other courses is not as effective as it could and should be, but there is a fair amount of this effected in a variety of ways. Just what the total impact is on the minds of medical students is not apparent. I would not rate it very highly."

School No. 24—"We are not satisfied with the present inadequate program. We are considering several ways to strengthen the subject, with the help of Dr. X, our clinical associate professor."

School No. 75—"The teaching program here is far from satisfactory. This is part of a larger problem of teaching preventive medicine and public health. We are trying to break the class into a series of smaller groups, and give a better integrated program that way. The formal course in occupational medicine is three hours of lecture time in the fourth year. Furthermore, there are *never* (in my 12 years here) more than half of the 80 students present, and often as few as 10 or 12. Why? Because Preventive Medicine and Public Health commands the magnificent hour of 9:00 a.m. on Saturday *and* because we have no examination to shake them out of their indifference."

Not all is disquieting, however, for new ideas were included in some of the discussions.

School No. 40—"Geographical joining of the medical school with the University of X campus offers many new opportunities. So far, the care of occupational injuries of University employees (Departments of Surgery, Medicine, and Preventive Medicine) and preplacement and periodic examinations of workers in X Laboratory (Nuclear Physics) have been established. Introduction of occupational health topics in basic medical sciences (especially physiology and pharmacology) is 'on paper' but it's too soon to say how effective this will be—there are considerable problems. Periodic health examinations are done in the general clinic, where several industrially oriented full-time and part-time faculty members serve as consultants."

School No. 43—"We are presently negotiating in an effort to locate a qualified occupational physician who would have a full-time job in a nearby large industrial plant, but who would spend some time here in undergraduate and post-graduate teaching and would receive part of his salary from this institution."

School No. 60—"I think our method of an intensive three to three-and-a-half day 'in-plant' session with lectures, demonstrations, and plant tours, held in a different industry each day, is unique. Presently included are a biologic manufacturing concern, a heavy machinery plant and foundry, and a meat packer and sausage manufacturer. The professor and associate professor of industrial medicine from the school participate in our program."

School No. 64—1. "Our formal lectures consist of four one-hour-and-a-half panel discussions of the environmental factors producing a disease state. We use appropriate panelists: chemists, physicians, hygienists, etc.—to tell the story best to junior and senior medical students."

2. "All questionable and known toxicology or occupational disease cases are seen by a member of the Department of Occupational Health. Cases are then discussed with occupational health clerks both formally and informally."

Information from Schools Planning Programs in the Future

School No. 30—"Program is planned for inclusion in the curriculum when the institution becomes a four-year school of medicine. No particulars of planning developed as yet."

School No. 42—"The program is planned for introduction in 1960 and will be placed in the Department of Preventive Medicine and Public Health. The instruction will consist of four hours in the junior year and six in the senior year. The instructor will be on a part time basis, holding an appointment as lecturer, and although appointments for three other instructors are planned, whether or not these will be 'clinical' has not been decided. The curriculum will consist of didactic lectures, field trips, and seminars. Although an industrial hygienist will assist in the presentation, there will be no participation by preclinical instructors. Special assignments will be omitted, but the student and employees' health service will be utilized for teaching."

School No. 53—"The program is in the early

stages of planning. No particulars have been developed as yet."

School No. 57—"The date of activation for the program of this institution has not been decided, but the teaching will be the responsibility of the Department of Industrial Medicine and Hygiene, which will offer six hours in the freshman year, six hours to sophomores, and eight hours each to juniors and seniors, for a total of 28 hours. The instructors will be on a full-time (seven) and part-time (five) basis. Some will have clinical appointments with academic levels ranging from professor, associate professor, assistant professor, instructor, lecturer, and associate. The group of instructors will include a chemist, a dermatologist, an engineer, an industrial hygienist, a physiatrist, a rehabilitation specialist, a sanitary engineer, and a veterinary scientist. Members of the preclinical sciences faculty will be utilized in the instruction, and special assignments will be given to the students. The course will be elective and will include didactic lectures, seminars, presentation of clinical material, demonstrations, and laboratory activities. The facilities of the student and employees' health service will be utilized in the teaching."

Comment

There has been a slight growth in the number of schools offering material in occupational medicine at the undergraduate level since the initial survey in 1954, and participation by departments of preventive medicine and of public medicine has more than doubled. However, although the total number of schools giving instruction has increased, there has been a drop in the total number of hours of instruction in occupational medicine, per school, from 17.7 in 1954 to 12.8 in 1960. The greatest decrease of the three years in which teaching is given has occurred in the senior year, in which teaching of this specialty has dropped from 17.4 hours per school year in 1954 to 9.3 hours in 1960. Many more instructors are providing teaching services at medical schools, and more part-time faculty members are coming from industry and from state governmental agencies to provide an experienced background to the curriculum. All varieties of teaching situations are utilized, including lectures, field trips, seminars and the like, and each type of teaching has shown an increase over six years, with the exception of actual laboratory work.

The teaching is characterized by a team approach, wherein representatives of 25 different medical, physical science, engineering, and social science disciplines participate throughout the country. Of interest is the fact that since the last survey was conducted, 24 schools reported that their teaching programs were initiated after 1956.

It is regretted that of 62 institutions having student or employees' health services, only four utilize these services for clinical teaching.

The location of the school within an industrialized area will make the teaching program a more realistic one, if the medical needs of workers can be demonstrated with little demand on the students' imaginations.

Summary

In reply to a questionnaire forwarded by the Committee on Education and Training of the Industrial Medical Association, 82% of the schools returned completed questionnaires, representing a response of 92% of the states involved, plus the District of Columbia. Questionnaires were returned from 75% of the schools in Canada included in the study. Currently, 70 medical schools are offering formal instruction in occupational medicine, and 76% of the schools are giving this training in the Department of Preventive Medicine and Public Health. The average number of instruction hours in the sophomore year is 6.6, with 8 hours in the junior year and 9.3 hours in the senior year. The average number of instruction hours in all the school years allotted to occupational medicine per school is 12.8. In only 41 per cent of the schools replying was the instructor a full-time faculty member, and part-time faculty members instructing in occupational medicine came from industry, government agencies, insurance companies, or served as consultants to large and small plants. Of the instructors, 67 held professorial rank, and in all cases but one the courses were mandatory. The type of instruction included lectures, field trips, seminars, presentation of clinic material, demonstrations and laboratory work. In only nine of the 70 schools replying did preclinical sciences faculty members participate in the teaching, and but seven of the schools had special assignments as part of the instruction, such as term papers, plant surveys, and research problems. Few programs existed prior to World War II, and since 1946, 42 teaching programs have been initiated in the schools of medicine. Only four of the schools are using the employees' or student health services for clinical teaching. Factors favoring the teaching program include the location of the medical school is an industrialized area, proximity to treatment or rehabilitation facilities, opportunities for field trips, and the orientation of certain members of the faculty.

Conclusion

In 1954, only 39 schools in the United States

were teaching occupational medicine, whereas in 1960, there were 70 American and Canadian schools with programs. The increment in active teaching and interest in the six-year period serves as a favorable sign of professional acceptance and support of the inclusion of occupational medicine in the curriculum.

Acknowledgments

Appreciation is expressed to Mr. Robert Cole for technical assistance in the compilation of the data.

The following schools participated in the survey: *Alabama*—Medical College of Alabama. *Arkansas*—University of Arkansas School of Medicine. *California*—University of California School of Medicine, Berkeley; College of Medical Evangelists; University of Southern California School of Medicine; Stanford University School of Medicine; University of California, Los Angeles School of Medicine. *Colorado*—University of Colorado School of Medicine. *Connecticut*—Yale University School of Medicine. *District of Columbia*—George Washington University School of Medicine; Howard University College of Medicine. *Florida*—University of Florida College of Medicine; University of Miami School of Medicine. *Georgia*—Emory University School of Medicine; Medical College of Georgia. *Illinois*—Northwestern University Medical School; University of Chicago, The School of Medicine; University of Illinois College of Medicine, Chicago Medical School. *Indiana*—Indiana University School of Medicine. *Iowa*—State University of Iowa College of Medicine. *Kansas*—University of Kansas School of Medicine. *Louisiana*—Louisiana State University School of Medicine; Tulane University School of Medicine. *Maryland*—Johns Hopkins University School of Medicine; University of Maryland School of Medicine. *Massachusetts*—Boston University School of Medicine; Tufts University School of Medicine. *Michigan*—University of Michigan Medical School; Wayne State University College of Medicine. *Minnesota*—University of Minnesota Medical School. *Mississippi*—University of Mississippi School of Medicine. *Missouri*—University of Missouri School of Medicine; St. Louis University School of Medicine; Washington University School of Medicine. *Nebraska*—Creighton University School of Medicine; University of Nebraska College of Medicine. *New Jersey*—Seton Hall College of Medicine and Dentistry. *New York*—Albany Medical College; University of Buffalo School of Medicine; Columbia University College of Physicians and Surgeons; New York Medical College; New York University College of Medicine; University of Rochester School of Medicine and Dentistry; State University of New York College of Medicine, Syracuse; Albert Einstein College of Medicine of Yeshiva University. *North Carolina*—Bowman Gray School of Medicine of Wake Forest College; Duke University School of Medicine; University of North Carolina School of Medicine. *Ohio*—University of Cincinnati College of Medicine; Western Reserve University School of Medicine; Ohio State University College of Medicine. *Oklahoma*—University of Oklahoma School of Medicine. *Oregon*—University of Oregon Medical School. *Pennsylvania*—Jefferson Medical College of Philadelphia; University of Pennsylvania School of Medicine; Woman's Medical College of Pennsylvania; University of Pittsburgh School of Medicine. *Tennessee*—University of Tennessee College of Medicine; Meharry Medical College; Vanderbilt University School of Medicine. *Texas*—University of Texas Southwestern Medical School; University of Texas Medical Branch. *Utah*—University of Utah College of Medicine. *Vermont*—University of Vermont College of Medicine. *Virginia*—University of Virginia School of Medicine. *Washington*—University of Washington School of Medicine. *West Virginia*—West Virginia University School of Medicine. *Wisconsin*—University of Wisconsin Medical School; Marquette University School of Medicine. *Alberta*—University of Alberta Faculty of Medicine. *British Columbia*—University of British Columbia Faculty of Medicine. *Manitoba*—University of Manitoba Faculty of Medicine. *Ontario*—University of Ottawa Faculty of Medicine; Queens University Faculty of Medicine; University of Toronto Faculty of Medicine. *Quebec*—Laval University Faculty of Medicine; University of Montreal Faculty of Medicine. *Saskatchewan*—University of Saskatchewan College of Medicine.

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Training in Industrial Hygiene in the U. S.

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INDUSTRIAL hygiene is a well-established field of specialization in the United States, represented by a membership of well over 1200 in the American Industrial Hygiene Association and the American Conference of Governmental Industrial Hygienists. Professionals in the area, who come principally from the parent fields of the physical sciences and engineering, work in close collaboration with industrial physicians and medical scientists and share with them a joint responsibility for securing and maintaining the health, productivity, and well-being of workers in industry. The important difference between the two groups is in their respective points of attack upon occupational health problems. Industrial hygienists focus their attention upon work conditions and the physical environment, whereas man is the center of interest on the medical side. The need for such interprofessional teamwork in industrial health maintenance is in recognition of the fact that the occupational diseases and many other problems of ill health among industrial workers are caused by physical and chemical stress factors in the work environment. From this it follows that, for a full understanding of the man-environment relationships involved in the disease etiologies and of the measures required for their control, the peculiar knowledge and skills of the physical scientist and engineer are needed along with those of the medical scientist and physician. There is mutual interdependence among the members of the team, each drawing upon the others to supplement and strengthen his own skills in dealing with his part of the total problem—on the human or on the environmental side.

Industrial hygiene has been defined by the American Industrial Hygiene Association as "that science and art devoted to the recognition, evaluation, and control of those environmental factors or stresses arising in or from the work place, which may cause sickness, impaired health and well-being, or significant discomfort and inefficiency among workers or among citizens of the community." The key words in this definition are *recognition, evaluation,* and *control.* The implications are that it is possible, by systematic examination of the work conditions and environment, using physical instruments and methods of analysis, to discover potential health hazards, to determine their magnitude and to *predict* the nature and extent of the ill effects which may be produced in exposed individuals and, through engineering analysis and design, to devise, install, and operate appropriate control measures which will bring potentially harmful stresses within tolerable limits for man.

The significance of these implications, if we must look for deep meaning, is in the use of physical methods of measurement and analysis of the environment to give physiological and medical answers to questions pertaining to man and his capacity to deal with external stress. The industrial hygienist has to recall that there is nothing inherent in his methods that insures such useful information or gives correct answers. No physical measurements of dustiness, of radiation, heat, noise, or light, of chemical fumes or vapors, no matter how precisely these are made, have direct biological meaning but are useful only in proportion to the goodness of their respective calibrations, so to speak, against appropriate biological scales of human health. Thus, standing alone on its foundation of physical science and engineering, industrial hygiene would have little meaning. Through teamwork, however, between the medical scientists and physicians, on the one hand, and the physical scientists and engineers, on the other, it has developed on a strong biophysical base, which provides the link between environment and man. It may be noted here that progress on the medical side is equally limited without such a common base in both the physical and biological sciences. The medical diagnostic techniques, like the physical procedures of the industrial hygienist, when used alone will not tell us that an observed state of ill health was necessarily

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caused by a particular industrial exposure. Such interpretation is permitted only when the diagnostic findings can be evaluated in relation to quantitative description of the conditions of exposure and both examined in the light of previously established correlations between similar environmental stresses and human response. It enhances the professional stature of both industrial medicine and industrial hygiene to recognize this mutual dependence upon a common base of knowledge and understanding which comes from the merging of biological and physical sciences and their counterparts in practice: medicine and engineering.

Industrial hygiene, functioning in this way as a partner with industrial medicine, has a history of a half-century in the United States. In association with Dr. Graham-Rogers, of the New York Department of Labor, John H. Vogt, a chemist, began to make systematic measurements in industry of dusts, lead fumes, and environmental temperatures, early in the 1900's. A mining engineer, E. Higgins, was associated with Dr. A. D. Lanza in the first systematic study of silicosis in American mines, carried out by the U. S. Public Health Service and Bureau of Mines, shortly after 1912. Leonard Greenburg was appointed as an industrial hygiene engineer on the Public Health Service staff in 1918 and shortly thereafter was joined by J. J. Bloomfield, a chemist. About this time Philip Drinker, a chemical engineer, joined his physician brother, C. K. Drinker, in the Department of Applied Physiology of the Harvard Medical School and later organized and directed the Department of Ventilation and Illumination and its successor, the Department of Industrial Hygiene, in the School of Public Health. In the early 1920's, William Fehnel, a chemist trained in industrial hygiene by the Drinkers, joined with Drs. Wright, Lanza, and McConnell to organize the first industrial hygiene service offered by an insurance company. The medical-engineering association of Dr. Roy Gardner and Donald Cummings at the Saranac Laboratory is another outstanding example of early interprofessional approach to occupational health problems.

In the universities, the Institute of Hygiene, established at the University of Pennsylvania in 1892, had an early interest in industrial hygiene, identified particularly with the work of Dr. Henry Field Smyth, who began a series of industrial hygiene surveys in various industries and experimental studies in 1916. His work on organic and mineral dusts, industrial anthrax, spray painting, carbon tetrachloride, and others are well known. A course on industrial hygiene was offered by Professor C.-E. A. Winslow in the Harvard-M.I.T. School of Public Health in 1910. Greenburg and Winslow organized at Yale in 1918 a training program for industrial hygienists to work in the war industries of that period. The first formal program of graduate training in industrial hygiene for engineers was offered jointly by the Harvard School of Public Health and Engineering School in 1927, under the leadership of Philip Drinker, of the Department of Industrial Hygiene, and Gordon M. Fair, of the Department of Sanitary Engineering.

During the decade, 1920-1930, the Public Health Service began its well-known series of studies on "The Health of Workers in the Dusty Trades," and in these and other expanded activities, greatly advanced the concept of interdisciplinary teamwork in the systematic study of occupational diseases. The Bureau of Mines was equally active during this period, engaged in a variety of studies of toxic materials, mine dusts and gases, employing jointly in these investigations physicians, physiologists, chemists, and other physical scientists and engineers.

These and other early developments set the stage for the rapid development of occupational health services in the 1930's in which the partnership of industrial medicine and industrial hygiene was further strengthened and expanded. Industrial hygiene programs were established in the several state departments of public health; a number of casualty insurance companies organized industrial hygiene staffs to serve their policy holders; and industrial hygienists were employed to supplement medical services in the industries. The Industrial Hygiene Foundation of the Mellon Institute was organized in 1935, to provide scientific, medical, and engineering research and field services and advice on occupational health problems to its member companies.

The majority of industrial hygienists in the United States today have come to the field without special university training beyond their preparation for engineering, chemistry, or other parent field. Some have had short intensive courses in industrial hygiene, given by a university, by the Public Health Service, or as a part of in-service training programs within their own organizations. Others have acquired competence in the field primarily through direct work in association with other experienced persons. The fact that able industrial hygienists have thus developed raises some important questions as to what is most needed in a formal program of graduate training for this field. Evidently, it is not primarily to acquire new knowledge in special areas of

technology involved in industrial hygiene or to develop skills in particular methods of physical and chemical analysis. There must be mastery of these, obviously, but mainly as extensions of knowledge in physical science or engineering which, presumably, are acquired rather easily by persons with appropriate background training in one or another of the parent fields. The industrial hygienist must have a capacity to draw upon a varied body of knowledge, in chemistry and other areas of physical science, engineering and industrial technology, biology, medicine, human relations, and the like, and it has been suggested that the purpose of further training is to provide him with such miscellaneous knowledge, properly systematized for practical application to the many different kinds of problems that come to him for solution. But this suggests little more than encyclopedic knowledge and implies that industrial hygiene practice involves only the orderly application of such knowledge, brought together and systematized in a second-hand fashion, so to speak, from a variety of sources, including such fields as physiology, biochemistry, toxicology, and medicine, which are essentially foreign to the background education of the physical scientist and engineer. The industrial hygienist, however, does not play such an uncritical role. Without attempting to become a physician or physiologist, he must nevertheless acquire an independent capacity to understand and evaluate the human side of the man-environment equation in order most wisely to employ his primary skills in physical science and engineering to "recognize, evaluate and control" the work environment. The central need in graduate training for industrial hygiene, then, is to develop such capacities to look at the human health problems arising out of the work conditions in industry in appropriate biophysical terms.

The first formal graduate program for the training of engineers in industrial hygiene was established by joint action of the Schools of Engineering and Public Health in Harvard University in 1927. It is of interest to quote from a note published by Professors Fair and Drinker in the Harvard Alumni Bulletin, May 24, 1928: ". . . there is a need for engineers whose special studies have prepared them to cooperate with the industrial physician in problems of plant sanitation and hygiene . . . This program has been developed with a view to acquainting the student with the following fields of knowledge: (1) the functions of the human mechanism and its reactions to the environmental conditions to which it is exposed in the industries; (2) the scientific measurement of environmental factors and the recognition of unfavorable conditions or industrial hazards; (3) the reduction or elimination of unfavorable conditions by engineering means, such as the modification of dangerous manufacturing processes and the provision of mechanical equipment for the safeguarding of the worker's person and health; (4) the recording and evaluation by statistical methods of health risks in industrial occupations; (5) the wider field of sanitation that is concerned with the hygiene and protection of the worker and his family in industrial communities." This statement of objectives in 1928 is in remarkable agreement with the definition of industrial hygiene formulated by AIHA more than 30 years later, in 1959.

From the first undertaking at Harvard, full-time graduate programs in industrial hygiene are now offered in several universities: University of Cincinnati, Harvard University, University of Michigan, and University of Pittsburgh. These programs have been developed for the most part in Schools of Public Health* with their unique opportunities for interdisciplinary approach to the field and for study of occupational health problems within the total framework of public health. Graduates in engineering or the physical sciences are thus able to work directly with graduates in medicine in joint study of the common field of interest, each group complementing and supplementing the other with their respective competencies in the physical and biological sciences.

The faculties are similarly constituted on an interdisciplinary base and include physiologists, toxicologists, radiobiologists, physicians, chemists, physicists, and engineers. There are certain differences in the details of the several programs of study, but basically they have the same structure and objectives. A typical program of study, leading to a master's degree, includes courses which may be grouped in the following categories:

I. Underlying courses in health science and public health practice
   - Biostatistics
   - Epidemiology
   - Environmental health
   - Public health practice

II. Health sciences, with particular reference to occupational health
   - Environmental physiology
   - Toxicology
   - Radiobiology
   - Principles of industrial hygiene and industrial medicine

*Kettering Institute of Industrial Health at the University of Cincinnati.

III. Specific practices in industrial hygiene
Methods of sampling, analysis and evaluation of industrial enviromental hazards
Industrial ventilation and other control measures
Radiation hazards measurement and control

The courses in public health practice, biostatistics, and epidemiology and in general environmental health give the student valuable insight into the whole field of public health, and its basic concepts and methods, within which he may fit the special area and practice of industrial hygiene. Courses in the second group —environmental physiology, toxicology, radiobiology, principles of industrial hygiene and medicine—provide an opportunity for the systematic study of physiological mechanisms and of man's capacities and limitations to adjust to various kinds of external stress. These courses, developed for both physicians and nonmedical students, emphasize the whole man-environment relationship and not just the internal adjustments in man and call as much upon a knowledge of physics, chemistry, and mathematics as they do upon biochemistry and physiology. Thus, they involve familiar territory for both groups of students and provide for both a common biophysical base. Further courses enable students to examine specific occupational health problems in relation to these basic considerations in physiology and biophysical science and with particular reference to the work conditions in industry which give rise to them. Courses in the third group deal with specific methods and practices in industrial hygiene: sampling methods and instruments and analytical procedures, design of industrial ventilation systems, engineering methods for control of hot environments, noise control, radiation shielding, and others. In these more detailed considerations of specific industrial hygiene practices, the principles and laws governing man's relation to the environmental stresses encountered in industry find direct application.

Advanced courses in some of the more detailed aspects of industrial hygiene and opportunities for direct participation in research are available in the several schools, depending upon the particular interests of their respective faculties. These include acoustics and noise control, aerosol physics and air cleaning, nuclear physics, reactor design, and other advanced problems in protection against radiation hazards, thermal physiology, the physiology of work, human factors engineering, and toxicology.

In consequence of the emphasis placed upon the biophysical base on which industrial hygiene is built, graduates from these programs are trained to discover, evaluate, and bring under control the known health hazards associated with particular occupations and industries, but, of greater importance, they are peculiarly fitted to meet the broader needs envisioned by Professors Fair and Drinker in 1927: to cooperate with industrial physicians in attack upon the new and different problems of health maintenance that are coming constantly to attention in our dynamic industries today. In this way, they have contributed most to the continued growth of industrial hygiene in the United States.

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Educational Opportunities for Industrial Nurses

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THE DUTIES of the first nurses brought into industry 75 years ago were restricted largely to providing first-aid treatment for industrial-accident victims. Today, many additional responsibilities are customarily assigned to nurses working within industry. Among other duties, industrial nurses assist with safety programs, industrial sanitation, health education, employee counseling, periodic health examinations, and the administration of employee-benefit programs.

The scope of industrial nursing has expanded rapidly, largely at the request and urging of industrial management. Management has become increasingly aware of the unique contributions a nurse, from her neutral, sympathetic niche, can make toward the physical and emotional fitness of employees. This realization, coupled with the fact that each employee has become more economically important by reason of the new skills and equipment he commands and his increased productive capacity, has caused management to encourage the industrial nurse to broaden her role. The rapidly evolving nature and responsibilities of the specialty has forced the problem of industrial-nursing education into sharp and critical focus.

By and large, the industrial nursing specialty has been shaped by the pressures and needs of industry, rather than by any educational or training philosophy. It is a unique feature of industrial nursing that most nurses have an opportunity for education in this specialty only *after* they have been hired by industry. Most of the existing courses for the specialty have been created for and often by practicing industrial nurses and their professional associations. In this effort, industrial nurses have been supported by industrial management with funds, time, and encouragement.

Perhaps the most varied educational opportunities for the practicing industrial nurse are to be found in her own professional organizations, programs sponsored by general nursing groups and by industrial nursing specialty associations. These organizations exist at the national, regional, state, and local level. Workshops, lectures, conferences, and symposia, sponsored by most of these organizations, make it possible for nearly all industrial nurses to participate in some type of educational program.

A number of higher educational centers have initiated special programs for industrial nurses in the nature of short courses, summer school sessions, institutes, and the like. A more recent and encouraging movement has been in the development of specified courses at the graduate level for which master's degrees are being offered. These programs, although established presently by only a few institutions, utilize a variety of educational centers and facilities within the sponsoring institution. As indicated by a preliminary survey, three examples of such programs are Yale University, Department of Public Health, Section of Occupational Health; New York University, Department of Nurse Education; and University of Washington School of Nursing.

Other educational institutions are now offering individual credit courses of value to industrial nurses. Included are Loyola University; University of Michigan; and New York University, Division of Occupational Medicine. In both the above instances, i.e., specialized programs and special courses, additional programs may now be in existence or may be in the formative stages. The institutions listed here, however, are examples of those making a major effort in this field.

Progress in the field of industrial nursing education is being made, also, in other nations of this hemisphere. While there are no degree programs in this specialty currently being offered in Canada, it is the author's understanding that some concepts are being integrated with public health nursing courses at

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*The author, while believing in the more inclusive term of "occupational health nursing," nevertheless, has elected to use "industrial nursing" throughout this presentation on the premise that it is a more definitive term for the purpose of this article.

several universities, including Queen's University and the University of Ottawa. Information is scarce in respect to the field in the Latin American nations; however, consultants have been and are being prepared in the United States for the purpose of establishing educational programs for the specialty in Latin America.

While certain measures have been taken to provide practicing industrial nurses with opportunities for education in their specialty, far less has been done to acquaint the student nurse with the skills and attitudes necessary for optimum on-the-job functioning. In the past, courses of this nature have not been included to any great extent in curricula at the undergraduate level. Considerable interest has been stimulated recently, however, as the result of a Guide[1] prepared by national professional groups, which gives depth, explanations, and methodology for the implementation of industrial nursing concepts into a basic program. Reports of successful implementation in various areas of the country hold promise for the spread of concepts at this level. Considering the importance of the field and its rapidly expanding responsibilities, it would seem that there exists a great challenge for both industrial nursing leaders and nursing educators to determine ways and means for further strengthening the factors of implementation to achieve even more significant results.

In general, it might be said that today there is a strongly felt need and desire for educational opportunities in the field of industrial nursing. The need and desire are perhaps both felt most strongly by practicing industrial nurses who are constantly faced with the challenge of new responsibility. Stimulated by this demand, educational institutions are beginning to provide some of the opportunities which the specialty seeks, and it appears a logical and hopeful prediction that more effective educational efforts at all levels will be developing in the future.

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The programs of postgraduate education are designed to qualify physicians for a Master's Degree and to meet the requirements of the American Board of Preventive Medicine in these component specialties.

The course of study in both specialties is given concurrently on the basis of an identity of interests and requirements necessary for proficiency. Hence, the first two years are devoted to study of basic disciplines of environment health and hygiene, while the third year is spent in medical organizations pertinent to the specific practice of either of these specialties.

Physicians who have completed one year of hospital internship may apply for either program, both of which have been approved by the AMA Council on Medical Education and Hospitals.

For further information and application forms, write: William F. Ashe, M.D., Chairman, Department of Preventive Medicine, The Ohio State University, 410 West Tenth Avenue, Columbus 10, Ohio.

Research in Occupational Medicine in the United States

T. G. Rigney, M.D., and R. E. Eckardt, Ph.D., M.D., Linden, N. J.

THE AUTHORS were asked by the editor of the *Journal of Occupational Medicine* to prepare a list of centers in the United States at which research in occupational medicine was being carried out. This list was prepared for use as a reference source for attendees at the XIII International Congress so that, in conjunction with their attendance at the Congress in New York City in July, 1960, they might arrange to visit one or more of the centers which are conducting research that is of particular interest to them. In this regard we should like to caution anyone using the following list and table that it would be best to make arrangements concerning each visit with the man listed as the primary contact for each center as far in advance of the visit as possible. The summer months in the United States are traditionally those used for vacations, and the number of persons present at each location mentioned in this compilation will understandably be less during July and August than at any other time during the year.

In preparing this compilation we wrote to the universities, private industries, and private laboratories which were performing research in the field of occupational medicine. Forty-five of these centers responded and in their reports included detailed outlines of research being carried out by more than 160 individuals. In order to include all this information in the space allotted to us, we had to resort to the cross-index type of table which follows later. It was also necessary to select arbitrarily 20 areas of research in occupational medicine which would likely be the most interesting to visitors, and to attempt to fit each of these individual researcher's projects into one of these 20 areas. The various centers which responded to our original and follow-up inquiries were found to be located in 14 states, and these states are listed along the top of the table which follows. The 20 areas of research being carried out are listed in the left-hand column of that same table. In the columns of the table will be found numbers corresponding to the numerical designation given to each center under the state in which it is located.

One of the yardsticks by which the maturity of a medical discipline can be measured is the amount of research being carried out in that particular specialty. Although the response to the original inquiry was heartening and somewhat overwhelming, a look at the table will show us certain areas in which there is a definite need for more research at the present time. Among these can be listed illumination, research in the problems of the alcoholic in industry, health education, and research into the best possible methods of teaching this specialty either as an undergraduate or as a postgraduate discipline. Toxicology—both basic and clinical—appears to be getting the large amount of attention which it deserves, and the toxicological work will probably increase in the future owing to the recent legislation which is to be administered by the Federal Food and Drug Administration.

We hope that as many of you as possible will use this list, first, to augment your own attendance at the XIII International Congress; second, as a handy reference to research which is now being carried out in occupational medicine in this country; and, third, as a stimulus to begin research in those areas in which it seems to be lacking.

Alabama

1. Reynolds Metals Company, P. O. Box 191, Sheffield, C. Craig Wright, M.D.

California

1. University of California Medical Center, Schools of Medicine and Public Health, Division of Occupational Health, Los Angeles 24, J. S. Felton, M.D.

From the Medical Research Division Esso Research and Engineering Company, Dr. Eckhardt, Director, and Dr. Rigney, Acting Assistant Director.

2. University of California School of Public Health, Earl Warren Hall, Berkeley 4, Bernard D. Tebbens, Sc.D.
3. University of California Medical Center, School of Medicine, Department of Preventive Medicine, (Occupational Health Group), San Francisco 22, C. H. Hine, M.D., Ph.D.
4. University of Southern California School of Medicine, Department of Pathology, 1200 N. State St., Los Angeles 33, Paul Kotin, M.D.
5. Stanford Medical Center, Stanford University School of Medicine, Department of Preventive Medicine, 300 Pasteur Drive, Palo Alto, Rodney R. Beard, M.D.
6. Stanford Research Institute, Menlo Park, Mr. Charles Elkind.

Connecticut

1. Yale University School of Medicine, Section of Occupational Health, 310 Cedar St., New Haven, J. Wister Meigs, M.D.

Delaware

1. Atlas Powder Company, Wilmington 99, Mr. Joseph F. Treon.
2. Hercules Powder Company, Wilmington 99, John P. Frawley, Ph.D.

Florida

1. University of Miami School of Medicine, Department of Pharmacology, Coral Gables 34, W. B. Deichmann, M.D.
2. Resources Research, Inc., P. O. Box 3248, Lakeland, Eugene H. Krackow.

Illinois

1. The Chicago Medical School, Division of Oncology, 2755 W. 15th St., Chicago 8, Philippe Shubik, M.D.
2. The University of Chicago, Chicago 37, United States Air Force Radiation Laboratory, 930 E. Fifty-Eight St., Kenneth P. DuBois, M.D.
3. Industrial Bio Test Laboratories, Inc., 1810 Frontage Road, Northbrook, Mr. J. C. Calandra.

Maryland

1. U. S. Army Environmental Health Laboratories, Army Chemical Center, Col. Rapalski.
2. U. S. Army Chemical Warfare Laboratories, Army Chemical Center, Keith H. Jacobson.
3. U. S. Navy Toxicological Unit, National Naval Medical Center, Bethesda, Jac Siegel, CDR, MSC, USN.
4. U. S. Public Health Service, National Institutes of Health, Bethesda 14, James A. Shannon, M.D.
5. The Johns Hopkins University, Department of Environmental Medicine, School of Hygiene and Public Health, 615 N. Wolfe St., Baltimore 5, Anna Baetjer, Sc.D.

TYPE OF RESEARCH	Ala.	Calif.	Conn.	Del.	Fla.	Ill.	Md.	Mass.	Mich.	N. J.	N. Y.	Ohio	Pa.	Va.
Administration and organization of occupational health services	....	3	....	....	....	3	1, 4*	....	....	....	6a	....	....	2
Air pollution	....	3, 2	....	....	1	....	3	1	3, 2	1	....	3	....	....
Alcoholism	....	1	....	....	....	....	....	....	....	....	....	....	4	....
Carcinogenesis	....	3, 2, 4	1	1, 2	1	3, 1	4*	....	....	1	2	3, 4	3, 2, 1	1†
Cardiopulmonary and cardiovascular	....	....	....	....	....	....	4*	....	3	....	1	....	1	....
Dermatology	....	....	....	2	....	3, 1	4*	....	....	1	2	3, 4	....	....
Health education	....	1	....	....	....	....	....	....	....	....	6a	....	....	....
Heat and cold	1	....	....	....	....	....	5	....	1	1	3	1	1	....
Illumination	....	....	....	....	....	....	....	....	....	1	....	....	....	....
Mental health	....	....	....	....	....	....	4*	....	....	....	....	....	....	....
Noise and hearing	....	....	....	....	....	....	4*	....	2, 1	1	3	....	1	....
Physiology and metabolism	1	....	1	2, 1	2, 1	....	5, 2, 4*	....	3, 2	1	6b, 3, 2, 1	1, 3	4	1†
Pneumoconioses	....	....	....	....	....	....	4*	1	3	....	....	3, 4	3, 2	....
Radiation: detection & monitoring	....	....	....	....	....	....	....	....	1	1	7a	2, 4	....	....
Radiation: physical effects	....	6	....	....	1	2	5	....	2, 1	1	7a, 7b, 2	2, 4	....	....
Rehabilitation	....	1, 5	....	....	....	....	....	....	....	....	1, 2	....	1	....
Teaching: Postgraduate education in occupational health	....	1	....	....	....	....	....	....	....	....	1, 2	3	1, 2	....
Toxicology, basic	....	3, 2, 4, 6	....	2	2, 1	3, 2, 1	5, 3, 2, 4*	1, 2	2	1	7a, 6b, 5, 4, 3, 2	2, 1, 3, 4	4, 3, 2	3, 2
Toxicology, clinical	....	3, 2, 4, 6	....	2	2, 1	3, 2, 1	5, 3, 2, 4*	1, 2	2, 1	1	7a, 6b, 2	2, 1, 3	3, 1	1†
Ventilation	....	....	....	....	....	....	5, 3, 6*	....	2, 1	1	....	....	1	....

Although the National Institutes of Health are located in Bethesda, Md., Dr. James A. Shannon administers through that office some 25 grants for research in the categories listed as 4 under the Maryland column. This research is being done in locations other than Bethesda, and the exact addresses can be obtained from Dr. Shannon.

†Research being supervised by Dr. James M. MacMillan for the Reynolds Metals Company is carried out in locations other than Richmond, Va., and exact addresses can be obtained from Dr. MacMillan.

Massachusetts

1. Harvard School of Public Health, 55 Shattuck Street, Boston 15, Prof. Philip Drinker.
2. Massachusetts Institute of Technology, Cambridge 39, Harriet Hardy, M.D.
3. Liberty Mutual Life Insurance Company, Research Laboratory, Boston, W. Frederick, M.D.

Michigan

1. The Dow Chemical Company, Biochemical Research Laboratory, Midland, Don D. Irish.
2. University of Michigan, Institute of Industrial Health, 1630 University Ave., Ann Arbor, Seward E. Miller, M.D.
3. Wayne State University College of Medicine, 1401 Rivard St., Detroit 7, Arthur J. Vorwald, M.D.

New Jersey

1. Esso Research and Engineering Company, Medical Research Division, P. O. Box 45, Linden, Robert E. Eckardt, M.D., Ph.D.

New York

1. Columbia University School of Public Health and Administrative Medicine, 600 W. 168th St., New York 32, Leonard J. Goldwater, M.D.
2. New York University—Bellevue Medical Center, Institute of Industrial Medicine, 550 Fifth Ave., New York 16, Norton Nelson, Ph.D.
3. American Cyanamid Company, Central Medical Department, 30 Rockefeller Plaza, New York 20, C. Boyd Schaffer, Ph.D.
4. Union Carbide Corporation, 30 E. Forty-Second St., New York 17, Thomas W. Nale, M.D.
5. Food & Drug Research Laboratories, Maurice Avenue at 58th St. Maspeth 78, New York City, Miss Mona Oser.
6. (a) Eastman Kodak Company, Medical Department, 343 State St., Rochester, James H. Sterner, M.D.

   (b) Eastman Kodak Company, Kodak Park Works, Rochester 4, David W. Fassett, M.D.

Ohio

1. The Ohio State University Medical Center, Columbus 10, William F. Ashe, M.D.
2. U. S. Public Health Service, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Arthur C. Stern.
3. The Kettering Laboratory, University of Cincinnati College of Medicine, Eden & Bethesda Ave., Cincinnati 19, Robert A. Kehoe, M.D.
4. U. S. Public Health Service, Occupational Health Field Headquarters, 1014 Broadway, Cincinnati, L. J. Cralley, M.D.

Pennsylvania

1. University of Pittsburgh, Graduate School of Public Health, Pittsburgh 13, A. G. Kammer, M.D.
2. Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Henry F. Smyth Jr.
3. Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Henry H. Schrenk.
4. The Jefferson Medical College of Philadelphia, Department of Preventive Medicine, Division of Industrial Medicine, 1025 Walnut St., Philadelphia, Heinrich Brieger, Ph.D.

Virginia

1. Reynolds Metals Company, Reynolds Metals Building, Richmond 18, James M. MacMillan, M.D.
2. Hazleton Laboratories, P. O. Box 30, Falls Church, Ivor Cornman, M.D.
3. Woodard Research Corporation, P. O. Box 415, Herndon, Henry J. Horn, M.D.

(The authors' address is Medical Research Division, Esso Research and Engineering Company, P.O. Box 45, Linden, N.J.)

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Medical Aspects of Motor Vehicle Accident Prevention

Harold Brandaleone, M.D., New York, N.Y.
Seward E. Miller, M.D., Ann Arbor, Mich.

ACCORDING to the National Safety Council,[1] traffic accidents killed about 37,000 persons in 1958 and injured about 1,350,000. The latter figures refer to the number of injuries causing disability beyond the day of the accident. The United States Public Health Service estimated that about 4,700,000 injuries occur annually in automobile accidents. This figure is based on the National Health Survey made in 1957 and 1958 derived from household interviews. On the basis of these facts, it has been predicted that 1 person in every 10 in this country will be injured or killed in a motor vehicle accident within the next four years. This constitutes one of the nation's largest unsolved health problems. Physicians have not realized or accepted their responsibility in this problem as they have with heart disease and cancer.

The three major factors involved in motor vehicle accident prevention are the road, the vehicle, and the driver. Great strides have been made in the improvement of hazardous road conditions with improved highway design and construction. Motor vehicles have been improved for speed and maneuverability, but there is great need for improvement in automobile design to include safety features such as padded interiors, safety door catches, safety glass, rigid frame tops, safety belts, and shoulder harnesses. The human element, the major factor in accidents, however, has been neglected. It has been neglected particularly by the physician, who is the only person able to ascertain the physical, mental, emotional, and physiological impairments of a person and to evaluate these disabilities in relation to safe driving ability.

It is the responsibility of the physician to certify fitness for driving and to persuade a patient to discontinue driving when he is no longer able to drive with safety. For this reason, we are presenting pertinent material on motor vehicle accident prevention. We hope this material will assist the physician in determining which of his patients can drive a motor vehicle with safety. It is advisable to read in detail the "Medical Guide for Physicians in Determining Fitness to Drive a Motor Vehicle,"[2] published in the *Journal of the American Medical Association,* March 14, 1959, by the Committee on Medical Aspects of Automobile Injuries and Deaths. Also, the recommendations made by the Industrial Medical Association Committee on Standards for Vehicle Driving should be reviewed. We suggest that your patients read the pamphlet "Are You Fit to Drive?" prepared by the same Committee of the American Medical Association. In addition to preventing motor vehicle accidents, the physician must assume the responsibility of treating the injured motorist. The details of such treatment have been recommended by the Committee on Trauma of the American College of Surgeons.

It must be remembered that motor vehicle drivers may be classified in two general types —civilian or private drivers, and commercial or industrial drivers. The latter group includes transportation drivers. The physical and mental requirements for commercial vehicle drivers, especially transportation drivers who must drive eight hours daily in all types of weather, should be more rigid than for civilian drivers.

It is recommended that civilian drivers be examined every three years up to the age of 45 years and every two years thereafter. The commercial vehicle driver should have a pre-

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Presented at the Forty-Fourth Annual Meeting of the Industrial Medical Association, Chicago, Ill., April 30, 1959.

placement examination and a periodic examination every two years up to the age of 45 years and annually thereafter. Recommended history and physical examinations have been presented elsewhere.[3] A driver may have a disability that temporarily or permanently disqualifies him from driving. He may have an illness that directly or indirectly interferes with his driving ability. Any person who has a condition interfering with his ability to control a motor vehicle should be advised not to drive that motor vehicle.

Everyone agrees that a diabetic who takes insulin and is subject to frequent hypoglycemic reactions should not drive. Likewise, a patient with uncontrolled convulsions or a cardiac condition that might cause sudden unconsciousness should not drive. We will try to summarize the various conditions likely to be hazardous to assist you in advising your patients on the question "Are You Fit to Drive?"

In order for the physician to be able to determine whether his patient is qualified to drive with safety, he must obtain a complete history and perform a physical examination. The physician must ask himself the following questions: Does the patient have the personal characteristics of a safe driver? Is he emotionally stable? Does he become fatigued more readily than is normal? Does he take any drug that would interfere with his ability to drive with safety? Does he drink alcohol? Do infirmities of age interfere with his ability to drive with safety? Then from the physical standpoint the physician must determine whether the patient has a physical disability. Is his vision normal? Does he have diabetes or vertigo that might interfere with his ability to drive? Does the patient have a neurological disease or some other disorder that might cause him a sudden loss of consciousness while driving? If the physician is able to answer these questions, he should be in a position to determine whether his patient is qualified to drive with safety.

Personal Characteristics

The personal characteristics usually associated with repeated accidents or with a high accident rate are (1) low intelligence, (2) youthfulness, (3) egocentricity, aggressiveness, antisocial trends, and social irresponsibility.

Emotional Disturbances

Normal persons may temporarily become emotionally upset as a result of numerous stress situations. Temporary emotional instability may impair safe driving ability. A person may become so involved in his problem that he is indifferent to traffic and the world about him, or he may develop an actual depression and psychomotor retardation with slowed reflexes. Either reaction would cause him to be an unsafe driver. He may also become antagonistic, impulsive, or openly aggressive, with loss of judgment and sense of caution. Some patients may be in a state of emotional instability more or less permanently, and for this reason may be unsafe drivers until they have a better understanding of themselves. Patients with psychoneuroses represent an unknown factor as far as highway safety is concerned. Each patient requires an individual evaluation regarding his alertness, social behavior, and possible psychomotor retardation. A careful appraisal must be made of such patients, taking into account the medication they may be taking, to determine whether they are able to drive with safety. The psychotic individual also requires individual determination. Usually the frankly psychotic patient will be under hospital care and incapable of driving a motor vehicle. But those who are not hospitalized require very careful evaluation to determine their ability to drive safely.

Fatigue—Fatigued, drowsy, and sleepy drivers are responsible for many accidents because they are unable to make split-second decisions since their reaction time has been slowed. Some persons may be victims of "highway hypnosis" after driving on monotonous superhighways. Patients should be advised against the development of fatigue and told not to drive more than eight hours in one day. The vehicle should not be kept too warm, and the driver should be advised to stop and exercise every few hours and to take caffeine in the form of coffee or cola drinks.

Drug Reactions

Numerous drugs, either self-administered or taken at the direction of a physician, may produce reactions in some persons that would impair their ability to drive a motor vehicle with safety. The degree of impairment varies tremendously. Physicians should alert their patients not to drive until they are assured of experiencing no adverse reaction to any medication they are taking.[4]

Central Nervous System Depressants—These drugs will induce drowsiness, and patients taking these medications should not be permitted to drive. Hypnotics, sedatives, and anesthetics not only depress central nervous system activity, but also produce drowsiness and sleep. Small doses of these drugs may temporarily im-

prove a nervous person's ability to drive, but usually patients requiring such medication should be advised not to drive. The tranquilizing drugs, such as meprobamate, chlorpromazine, and reserpine, may produce some drowsiness. Great care should be taken during the initial phase of dosage adjustment to prevent any motor vehicle accidents that might result from drowsiness or faintness.

Central Nervous System Stimulants—A stimulant such as amphetamine temporarily increases alertnes and efficiency but in large doses may cause dizziness, agitation, irritability, and a decreased ability to concentrate, followed by a period of fatigue and depression. Therefore, after use of this medication, individuals should be advised not to drive.

Antihistaminics and drugs preventing motion sickness also cause dizziness and drowsiness. Persons taking such medication should be permitted to drive only after it has been demonstrated that they are not so affected.

Physical Conditions

Vision—Adequate vision is essential for the proper and safe operation of a motor vehicle. Visual acuity may be ascertained by the use of available vision testing instruments. It should be emphasized that visual acuity evaluation alone is not sufficient in determining the driving ability of a patient. Visual fields and ocular muscle balance must be tested. Dark adaptation and depth perception should also be checked. Color blindness does not seem to play an important role in accident causation.

At present it is believed that persons whose corrected vision under standard conditions is 20/40 or better may be advised that their vision is adequate for operating a private vehicle. Persons with less than 20/40 vision should be referred to an ophthalmologist in an attempt to improve their vision. Anyone with less than 20/70 corrected vision in the better eye should be advised not to drive.

Visual fields (form fields) of 140° or more may be considered sufficient for driving with safety. Persons with visual fields of less than 110° should be advised not to drive. Anyone with such constricted fields or a person who has severe glaucoma should not be permitted to drive. Ocular muscle imbalance may produce diplopia, and persons who have this condition should be advised not to drive.

Otolaryngology—Deafness and dizziness or vertigo due to internal or middle-ear disturbances are the principal otological symptoms of significance in the safe operation of a motor vehicle. Deafness may not be an important handicap, particularly when the deaf driver is conscious of his disability and is cautious and alert at all times. A hearing aid may improve his ability to drive a private vehicle. Patients with attacks of sudden dizziness should not be permitted to drive a motor vehicle.

Cardiovascular Disease—A patient with cardiovascular disease should have a complete history taken and examination performed in order for the doctor to evaluate his illness. In general, any cardiac patient who has a disease that might cause sudden unconsciousness or otherwise suddenly incapacitate him should be advised against driving a motor vehicle. Detailed discussion of cardiovascular diseases in relationship to driving has been presented elsewhere.[2,3] Briefly, aortic stenosis when severe may lead to sudden syncope and death. A patient with significant aortic stenosis should be advised against operating a motor vehicle. Severe disturbances in cardiac rhythm may cause sudden disability, and therefore patients likely to develop sudden disturbances in rhythm should be advised against driving a motor vehicle.

Hypertensive cardiovascular disease must be carefully evaluated. Hypertension in itself is not disabling for the safe operation of a motor vehicle, but the complications arising from hypertension, such as the damage to the brain, eyes, heart, or kidney, may very well prove disabling. When complications are limited to the optic fundi, the degree of impairment of driving should be evaluated carefully on the basis of the loss of vision.

Arteriosclerotic heart disease also presents difficult problems in evaluation. If a patient has had a mild attack of coronary occlusion, after he has completely returned to normal he may continue to drive a private motor vehicle but not a commercial or passenger transport vehicle. Each case must be evaluated individually.

Patients with cerebral vascular disease with inadequate cerebral blood flow are apt to have attacks of syncope and dizziness. They should be advised not to operate a motor vehicle. If a patient has had a cerebral hemorrhage or thrombosis or transient cerebral vascular spasm, he should be advised against driving.

Metabolic Diseases—In relation to safe driving, the most important of the metabolic diseases is diabetes mellitus. Patients who have diabetes that can be controlled with diet, or diet and an oral sulfonylurea drug, may be permitted to drive any type of motor vehicle. If insulin is required and the diabetes well controlled, the individual may drive a private

motor vehicle, but he should be advised not to drive a commercial vehicle or a passenger transport vehicle. Because of the possibility of a sudden attack of hypoglycemia, the uncontrolled diabetic should be advised not to drive any type of motor vehicle.

Thyroid disease and Addison's disease may also present some problems in driving. These patients should be evaluated individually. Details of these problems have been presented elsewhere.[2]

Neurological Disease—Convulsive disorders are the most frequent neurological problems to be considered in motor vehicle accident prevention. Epileptic patients who are not receiving medicine and who have been seizure-free for a minimum of two years may be considered good risks for the operation of private vehicles, but they should be advised not to drive a commercial or passenger vehicle. Such patients must be under constant supervision by a well-trained neurologist and submit to frequent periodic examination. Epileptic patients under medication should be advised not to drive a motor vehicle until they are seizure-free for a minimum of two years. Great caution must be exercised in permitting any person with a convulsive disorder to drive any type of vehicle. Examples of disorders affecting muscular control and coordination are paralysis agitans, poliomyelitis, progressive chorea, multiple sclerosis, and mental deterioration. Patients with these diseases should be evaluated individually to determine whether they are capable of driving. Patients with these diseases usually are not able to drive and are willing to discontinue driving of their own accord. Great care should be exercised in evaluating the ability of these patients to coordinate sufficiently well to drive with safety.

Alcohol Consumption—Alcohol is the responsible factor in a large percentage of motor vehicle accidents that are attributed to speed, reckless driving, or driving on the wrong side of the road. Detailed studies in selected areas have shown that approximately 50% of the accidents in which fatalities occur involve a drinking driver. Alcohol is considered one of the most important problems in motor vehicle accident prevention. Blood alcohol levels of 0.05%, or 50 mg per 100 cc of blood, have been shown to interfere with driving performance. The average individual with a blood alcohol level of 0.05% or higher suffers significant deterioration of his driving skill and is a potential menace on the highway. The public must learn the basic facts of the relationship between alcohol consumption and motor vehicle operation. One drink may be tolerated; two drinks puts one on the level of impairment for about two hours; three drinks are too many.

Summary

Traffic accidents constitute one of the nation's largest unresolved health hazards. Personal characteristics usually associated with repeated accidents are low intelligence, youthfulness, egocentricity, aggressiveness, antisocial trends, and social irresponsibility. The major conditions impairing driving ability are discussed under emotional disturbances, physical conditions, and alcohol consumption. Criteria are proposed as a guide to physicians in determining an individual's ability to drive a motor vehicle with safety. Physicians are able to ascertain the physical, mental, emotional, and physiological impairments of an individual and to evaluate these disabilities in relation to safe driving ability.

(Dr. Brandaleone's address is 116 East 63rd Street, New York 21, N. Y.; and Dr. Miller's address is 1634 University Hospital, Institute of Industrial Health, Ann Arbor, Mich.)

References

1. Accident Facts, Chicago, National Safety Council, 1958.

2. A.M.A. Committee on Medical Aspects of Automobile Injuries and Deaths: Medical Guide for Physicians in Determining Fitness to Drive a Motor Vehicle, *J.A.M.A.* 169:1195, 1959.

3. Brandaleone, H.; Blaney, L.; Irwin, G. H.; Kuhn, H. S.; Miller, S. E.; Penalver, R.; Seth, R. E.; Sim, R.; and Friedman, G. J.: Recommendations for Medical Standards for Motor Vehicle Drivers, *Indust. Med. & Surg.* 26:25, 1957.

4. Miller, S. E.: Drugs and Driving, *J. Michigan M. S.* 56:1131, 1957.

Translation

The Toxicology of Thallium

René Truhaut, Paris, France

IN PAPERS published before 1951, thallium was assumed to induce its effect primarily at the cellular level (Truffi), on the endocrine glands (Buschke et al.), and on the autonomic nervous system (Peter, Dixon, and others). Detailed and specific reports on the pharmacodynamic effects of thallium were published by Thyresson (1951). We have conducted certain studies which permit the following observations.

Reports of previous investigators who had referred to the slow onset of the signs of intoxication and to the differences in response induced by various modes of administration were confirmed.

Two effects attracted our particular attention, namely, marked loss of body weight and loss of hair. The latter effect was readily reproducible in very young but not in adult rats. Addition to the rats' diet of water and fat-soluble vitamins did not influence these effects. However, a high intake of cystine resulted in a definite protective effect due to a markedly augmented urinary excretion of thallium. Methionine was also protective, but to a lesser degree. In terminal cases of intoxication, albuminuria and an increased output of urea were noted, together with the appearance of hypercholesteremia. The sodium concentration did not undergo significant variation, but calcium and, especially, potassium were lowered considerably.

About 50 animals were examined to learn whether or not the signs and symptoms of thallium poisoning were related to specific morphological organ changes. It was found that thallium injured only certain organs. The principal lesions were in the skin (general hyperplasia with rarefaction and atrophy of hair follicles), in the testis (inhibition of spermatogenesis), and in the kidney (vacuolar degeneration of the convoluted tubules). In addition, degenerative lesions were noted (rabbit: acute intoxication) in the white matter of the spinal cord. These changes may be related to the paralysis of the hindlegs seen in the terminal phase of an intoxication. In many of the organs (except the testes) diffuse inflammatory lesions were noted. These were often hemorrhagic. The endocrine glands (hypophysis, thymus, adrenal, parathyroid, thyroid) did not show specific lesions. Our observations are not in complete agreement with those of other investigators.

We have studied thyroid function in great detail and have observed a slight lowering in the basal metabolic rate during the terminal phase of an intoxication. Absence of histopathological changes does not exclude the eventual production of functional disorders of this gland. However, our observations do not support the hypothesis that the thyroid is primarily involved in cases of thallium intoxication.

We have confirmed the inhibitory effect of thallium on the estrus cycle in rodents, an effect which can be reversed by injected estrogen. Our experiments were confined to young and to castrated adult animals. In the young, thallium did not inhibit the effect of the gonadotropic hormone. In castrated animals (given gradually increasing doses of thallium) the vaginal response to estrogen was suppressed. These observations have shown that the action of thallium on estrone took place in the vaginal epithelium, since the hypophysis and the ovarian receptor were eliminated as causative factors. These observations are contrary to those of Buschke et al., who placed the action of thallium at the level of the hypophysis and ovary.

A spectographic method was developed for the analysis of thallium in tissues. This procedure is sufficiently sensitive to determine

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René Truhaut is a Professor of the Faculty of Pharmacy of Paris.

This article is a free translation of Professor Truhaut's "Recherches sur la Toxicologie du Thallium." It was prepared for this *Journal* by William B. Deichmann, Ph.D., Professor of Pharmacology, University of Miami, Coral Gables, Florida. The original monograph is published by the Institut National de Sécurité pour la Prévention des Accidents du Travail et des Maladies Professionnelles, Paris, France.

quantitatively 0.02 μg of thallium. By this method, thallium was found in all organs. Regardless of the mode of administration or the species employed, the highest concentration of thallium were found in the kidneys, salivary glands, hypophysis, testes, ovaries, skeletal muscle, and eyes. Low concentrations were found in the brain, spinal cord, bones, and adipose tissue. In chronic intoxications, only low concentrations were found in the blood. The retention of thallium in the adrenal gland varies considerably. The concentration is relatively high in subacute and chronic intoxications in the rat. In chronic intoxications in the rabbit, retention is of a low order and in the hypophysis and testis of this species there may be no retention. Concentrations of thallium in the brain, liver, heart, spleen, and lungs are usually low. The dog seems to be an exception; in this species concentrations in these organs were relatively high. Thallium accumulates at the level of the germinative zone of the hair follicle. In the skin, concentrations are of a low order, except in acute intoxications.

In many respects, thallium behaves like mercury and lead. Prolonged administration of low doses results in retention and the production of signs of toxicity. The diffusibility of thallium resembles that of the alkaline metals.

In intoxications, the urinary excretion of thallium is much more important than the fecal elimination of this metal. In this respect, our conclusions are contrary to those that Thyresson reported for the rat but are in agreement with those of Shaw for the dog and DeFrey, Schlecter, and Testoni for the rabbit. Thallium is also excreted in the saliva.

It was decided to test the effect of thallium on mitosis, since thallium has a tendency to accumulate in the testes and hair follicles—that is, in tissues characterized by marked mitotic activity. A definite antimitotic action was noted. Glutathion and cysteine prevented this action. These cytological effects help us to understand the changes in spermatogenesis and the loss of hair.

Thallium salts (concentrations up to 0.00001 M) inhibit the respiration of yeast. Sulfhydryl derivatives did not prevent this inhibition. Salts of thallium also inhibit the uptake of oxygen by homogenates of liver, kidney, and heart. In suitable doses, succinic acid suppresses this inhibitory effect considerably. Relatively high concentrations of thallium (of the order of 0.61 M) were required to inhibit the enzymatic system of succinic acid or the dehydrogenation of the higher fatty acids, but we were not able to determine the specific stage in the enzymatic reaction which is blocked by thallium.

In chronic thallium poisoning, we found disturbances in the formation of bone. Phosphatases play a predominant role. No inhibition of acid phosphatase occurred with concentrations of thallium as high as 0.1 M. With alkaline phosphatases, inhibition begins at a concentration of 0.001 M. This effect is not suppressed by cysteine.

Inhibition of pseudocholinesterase in serum occurred at a concentration of 0.004 M. True cholinesterase is less sensitive. With both enzymes, the natural sulfhydryl derivatives (cysteine and glutathion) and disodium thiomalate afforded only incomplete protection. Although cholinesterase depression became apparent only at concentrations which *in vivo* produced parasympathomimetic effects, it is possible that the presence of thallium in the nervous system helps to reinforce its action.

Many investigators, particularly Buschke and his collaborators, presented evidence that thallium has a specific action on the autonomic nervous system. The final phase of our investigation was devoted to this study.

Our first problem was to determine whether the effects of epinephrine and acetylcholine on the cardiovascular system of the dog can be modified by thallium.

Thallium induced hypotension which disappeared on vagotomy. This hypotension masks a stimulant action of thallium on the sympathetics (revealed by hypertension after blockade of the parasympathetics by atropine). Since this hypertension occurs at the same time as renal vasoconstriction, and since this action is increased by sparteine (a ganglionic blocking agent), it does not result from ganglionic excitation, but is more likely due to stimulation of the sympathetic nerve endings. In agreement with this thinking is the fact that transfusion of the hindquarters of the guinea pig and frog induced vasoconstriction. In the course of other cardiovascular studies, we noted that thallium diminishes the hypotensive effects of epinephrine.

A specific effect of thallium on the chorda tympani was not observed, but the salivation which appears in the terminal phase of an intoxication is due to parasympathetic stimulation.

The vascular effects after administration of thallium (after blockade of the parasympathetic system) made us suspect a direct action on smooth muscles. To verify this hypothesis, the influence of thallium was studied on various types of smooth and striated muscles.

It was found that thallium induced diminution of tonus and a slowing of contractions but an increase in amplitude when added to a bath containing a strip of isolated intestine of the rabbit or rat. The increase in amplitude may have resulted from parasympathomimetic stimulation, but the drop in tonus must be associated with a direct depressing action of thallium on the muscle fibers. Finally, it was noted that in the presence of thallium the inhibitory action of epinephrine is lessened.

Thallium induced a diminution of amplitude and change in rhythm of the isolated heart of the frog and rabbit. Addition to the bath of vitamins or sulfhydryl derivatives of biological origin resulted in no protection. Riboflavin had a mild protective effect. Thallium depresses the guinea pig uterus.

Our previous studies had shown that thallium (in the concentrations used) diminishes the effects of epinephrine on the isolated heart and intestine and that it lowers the arterial blood pressure in the anesthetized animal. At first, we thought that this action was due to a parasympathetic type of effect; however, since these effects remained after parasympathetic blockade, we formulated the hypothesis that the effects of thallium might be due to destruction of epinephrine. Subsequently, we showed that a concentration of thallium of 0.002 M augmented the inactivation of epinephrine in the presence and in the absence of cardiac pulp.

Conclusions

1. Thallium appears to be highly diffusible. The compound is found in all organs. Certain tissues "fix" it more than others, for instance, the kidneys, salivary glands, hair follicles, skeletal muscle, and certain endocrine glands such as the thyroid, hypophysis, and testes.

In spite of its diffusibility, which permits it to pass through the placenta, thallium is tenaciously retained in the body. It is a cumulative poison and resembles in this respect the heavy metals, particularly mercury and lead.

2. Only at high concentrations (0.001 M) does thallium inhibit the enzymatic systems of succinic acid dehydrogenase, phosphatases, and cholinesterase. This concentration appears to be too high to be of significance from the standpoint of mechanism of action. Very probably thallium interfers with the metabolism of the sulfur-containing amino acids. In the rat, cystine and methionine protect against the general toxic action of thallium as well as against the loss of hair.

3. From the physiopathological point of view, thallium is characterized by "slowness" of action and by a multiplicity of signs and symptoms. Of the endocrine glands, only the testis is, on occasion, involved morphologically and functionally. In addition, the effects of the estrogenic hormones are partially antagonized. We do not support other investigators who have stated that the thyroid plays an important role in thallium intoxications, in spite of the fact that this gland, at certain times, may be the site of marked retention of thallium. In the terminal phase of an intoxication, the kidney sometimes shows marked histopathological changes. Finally, thallium induces characteristic lesions in the skin and loss of hair.

4. The antimitotic action of thallium is interesting and may play a role in the loss of hair.

5. From the pharmacodynamical point of view, the following should be emphasized:

(a) The action on the autonomic nervous system is complex, but parasympathomimetic effects predominate. Sometimes, and in certain areas, these effects are accompanied by stimulation of the sympathetic fibers.

(b) Thallium appears to be a musculotropic poison, but the effects are not similar to those of barium.

(c) Thallium augments the inactivation (oxidation) of epinephrine.

It is of interest that the pharmacodynamic action of thallium approaches that of potassium. This ion depresses the heart directly and also through its effect upon the parasympathetic nervous system; in addition, it induces vasoconstriction and hyperglycemia. Under certain conditions, thallium produces all of these effects. Thallium, however, does not share the stimulant action of potassium on smooth muscle fibers.

Mercury Toxicity from Industrial Exposure

A CRITICAL REVIEW OF THE LITERATURE—PART I

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THE HISTORY of mercurialism dates back to the time of the Roman civilization.[1] Early observers probably were fascinated by the protean appearance of the "quick-silver" metal; and later its toxic effects attracted the attention of such outstanding medical personalities as Plinius, Avicenna, Paracelsus, Ramazzini, and Kussmaul.

In the United States, the first mention of mercury as an industrial hazard appeared around the middle of the 19th century in connection with hatters employing a mercurial "carrot."[2] Today, because of the increased use of this toxic substance in various working environments, the medical literature on mercurialism is extensive. Good indications of the abundant use of mercury in the United States are its annual national production of more than 38,000 flasks of the refined metal and the total domestic consumption in 1957 of 53,000 flasks (4,028,000 lbs).[3]

The magnitude of the related risk of intoxication is not the only reason for centering our attention upon this problem. Mercurialism, after more than 2,000 years of use, presents not only an actual but an unresolved problem. It is actual because poisoning cases still occur in industry,[4] in various laboratories,[5] and, although infrequently, even in the home;[6] and the problem is unresolved because the details of the mechanism of toxicity are not satisfactorily known. An additional interest results from the large use of mercurial diuretics in modern medicine, a circumstance which provides a strong connection between industrial toxicology and the field of pharmacology.

The purpose of this review is to examine, summarize, and analyze the data provided by animal experiments and by observations on human cases, as these data relate to the variables of intake and subsequent handling by the body of mercury in different forms.

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Submitted for publication December 1, 1959.

Industrial Exposures

A careful listing of the trades associated with the use of mercury and its derivatives comprised, about 20 years ago, more than 50 industrial headings.[7] It seems worthwhile to mention here the main industrial uses of mercury which have given origin, during the last decade or so, to dangerous levels of exposure or to cases of actual poisoning.

Mining and refining the ore containing cinnabar (HgS) involve relatively few workers in different countries. The ore is mined in Europe, Russia, Japan, Africa, South America, British Columbia, Mexico, and the United States. Mining exposes the worker to a definite risk,[8, 9] despite the fact that cinnabar is only slightly soluble and therefore not readily absorbed. The probable cause of the reported industrial intoxications is the small amount of mercury metal dispersed in sandstone. As a matter of fact, high concentrations of mercury in air have been occasionally described in mine shafts in the form of vapor, aerosol, and/or contaminated dust.[9] A greater risk is associated with subsequent operations at the usual refining plant, particularly in connection with the cleaning of distillation columns.

Felt-hat manufacturing has for a long time dominated the statistics of mercurialism because of the large use of mercuric nitrate as a carroting agent. The mercury, at first bound with the keratin of hair, is in part released during the subsequent manipulation of felt in hot water.[10, 11]

Another source of mercury hazard is in the manufacturing of technical instruments,[8, 12] and the handling of elemental mercury in manometric apparatus is a common laboratory task frequently associated with measurable levels of atmospheric contamination.[11, 30] A careful inspection of such work places usually reveals

a dispersion of fine droplets of the metal on neighboring surfaces. Because of the great surface area presented for evaporation in relation to the amount of mercury involved, these droplets may in the aggregate contribute more to the over-all air contamination than the material being handled. Instances of clinical signs of mercurialism among the personnel so exposed have been reported.[5]

The manufacture of carbon brushes for electrical equipment sometimes involves the handling of a mercurial powder, an exposure which recently was responsible for an outbreak of mercurialism involving 36 workers in a small plant.[4]

Certain fluorescent lamps depend upon conduction of current through mercury vapor which is generated from a small pool. The manufacture of such lamps has been found to be associated with air levels of mercury up to 14 times the recommended maximum allowable concentration and in Japan was the cause of a few cases of mercurialism.[8] The assembling of neon signs may similarly induce dangerous levels of mercury vapor.[15]

The chemical production of mercurials may be associated with air levels above the safe concentration, even in modern plants.[16] A recently expanded industry, the production and use of mercurial insecticides, has been responsible for several acute and chronic intoxications, some resulting in death.[17, 18, 19, 20]

The use of mercury paints may present a hazard when the painted surfaces are subsequently subjected to high temperatures. Matthes et al.[6] recently reported an exposure of a mother and three children to fumes released from a space heater which had been painted with a mercury stain. All four became acutely ill with symptoms indicating involvement of the respiratory and digestive tracts and nervous system, and the three children died.[6]

A significant hazard is encountered in the repair of direct-current meters in which the armature revolves in a bath of mercury. As reported by Bidstrup et al.,[22] one such operation produced general shop-air concentrations up to 0.22 mg Hg/M^3 and levels up to 1.6 mg/M^3 at work benches. Twenty-six percent of a group of 161 repairmen so exposed were found to be intoxicated to a mild degree.

Toxicology

General Consideration of Toxicology—Several factors determine the degree of intoxication produced by mercury and its derivatives. A purely conventional grouping of these is as follows:

A. Amount and rate of absorption.
B. Physicochemical properties of the absorbed compound.
C. Individual susceptibility.

The influence upon the intoxication mechanism by any of the factors that comprise these groups will vary not only with the degree to which a given factor exists at a given time, but also in relation to the degree at which the other factors are simultaneously operating. We have a beginning understanding of the influence of some of these variables upon the manifestations of mercury intoxication.

The respiratory tract is the usual portal of entry of mercury and its compounds in industrial exposure. The skin has been suspected on several occasions as an additional route of entry.[13, 51, 52] Ingestion is considered possible only on the basis of extreme carelessness of exposed workers.[53]

Amount and Rate of Absorption—Neither the amount of mercury that constitutes a harmful total body burden nor the amount which is safely tolerated is known with satisfactory precision for man. A related value, the well-tolerated dose, can be indirectly inferred from the air concentration of 0.1 mg/M^3, which, on the basis of epidemiologic studies, is considered to be safe for a continuous work exposure.* If one assumes that about 25% of the elemental mercury or mercury compound in inhaled air is absorbed through the lungs,[33] that the average workman may inhale 5 to 10 M^3 contaminated air per working day, and that intake and excretion are in reasonable equilibrium, a daily dose of 2 to 4 μg/Kg is well tolerated. The observations upon humans which tend to support this conclusion as well as the relevant data of certain experimental animal studies that shed light on this question are listed in Tables I and II.

As is true for any potentially toxic substance, an effective amount of mercury absorbed into the body must enter within a certain time period in order to produce damage. Although no detoxication mechanism as such is recognized for mercury, if one does exist it must have a maximum operating rate. Mercury is eliminated from the body in an irregular but persistent manner, and harmful accumulations occur only when intake exceeds output. Quite apart from this quantitative relationship between intake and toxicity, the intensity of the exposure may have an influence upon the damage in the qualitative sense. Acute intoxication resulting from high intake over a relatively short period of time is manifested by nephrogastrointestinal effects. If the absorption stems

*For organic mercurial compounds the MAC is established at 0.01 mg/M^3 air.[27]

from very high air concentrations of mercury, various degrees of lung irritation will result[6, 12, 13] and in some cases the pulmonary changes will dominate the clinical picture. In contrast to this, chronic mercurialism is characterized mainly by neurological involvement. It is concluded, therefore, that the rate of absorption influences not merely the over-all intensity and duration of the intoxication but determines as well the degree to which specific organs are involved. But it must be emphasized that there is not always a sharp difference between the symptomatology of acute and chronic intoxication. Symptoms of each can be present in a great variety of combinations.

Physicochemical Properties—Differences in solubility and ionization constants have been relied upon to explain differences in the absorption, localization, and excretion of mercury in different forms. These properties do influence *absorption*, but there is no clear understanding of the part they play in any subsequent toxic *action* once mercury in some form has gained entrance into the body proper.

The importance of solubility to absorption is illustrated by the solubility differences of the two compounds, mercurous chloride (HgCl, calomel), and mercury bichloride ($HgCl_2$). The relatively insoluble mercurous chloride for the most part passes through the gastrointestinal

Table I—Mercury Poisoning by Inhalation: Human Case Experience in Various Industries

Author and Year	Industry	Compound or Material	Air Conc. (mg/M³ air)	Length of Exposure	Mercurialism Incidence in Exposed Workers
Neal et al.[20] (1937)	Fur cutting	$HgNO_3$; (Hg)	<0.2	2 or more years	4.5% affected
Neal et al.[20] (1937)	Fur cutting	$HgNO_3$; (Hg)	>0.2	2 or more years	17.1% affected
Neal et al.[10] (1941)	Felt-hat manufacture	$HgNO_3$; (Hg)	0.16-0.23	10-19 years	17.5% affected
Bidstrup et al.[22]	D.C. meter repair	Hg elemental	0.22-1.6	months	26% affected
Bell et al.[31]*	Laboratory	Hg elemental	0.15	7 months	single case
Goldwater et al.[5] (1956)	Laboratory	Hg elemental	0.1-0.2	1 year	single case
Kesic et al.[32] (1951)	Mining and smelting	Hg elemental	0.25-5.9	years	31.6% affected
Kesic et al.[32] (1951)	Felt-hat manufacture	$HgNO_3$	0.25-1.0	years	67.7% affected (women)
Benning[4] (1958)	Carbon brush manufacture	Hg elemental	0.2-0.75	months	69% affected
Hill[25] (1943)	Fungicides	Diethyl Hg	1.0	3 months	2 deaths
Dinman et al.[28] (1958)	Chemical Industry	Organic Hg derivatives	2.9-16.9	acute episodic exposure	3 acute cases
Massmann[29] (1957)	Chemical Industry	Phenyl mercury pyrocatechol	0.24-3.20	months	No intoxication
Dinman et al.[28] (1958)	Chemical Industry	Organic Hg derivatives	0.01-0.1	years	No intoxication

*Case resulted from exposure to Hg vapor at low atmospheric pressure.

Table II—Elemental Mercury Poisoning by Inhalation: Results of Animal Experimentation

Author and Year	Animal	Hg Air Level (mg/M³)	Length of Exposure	Toxic Effects
Frazer et al.[33] (1934)	Dogs	20.06	Hours	Lethal
Frazer et al.[33] (1934)	Dogs	>6.00-<20.0	8 days	Lethal
Frazer et al.[33] (1934)	Dogs	3.05-6.09	40 days	Central nervous system and digestive disturbance
Frazer et al.[33] (1934)	Dogs	<3.05	40 days	No evidence of intoxication
Ashe et al.[31] (1953)	Rabbits	28.8	1 hour	Histological changes
Ashe et al.[31] (1953)	Rabbits	6.0	1-2 weeks	Histological changes
Ashe et al.[31] (1953)	Rabbits	0.86	6 weeks	Histological, reversible changes
Ashe et al.[31] (1953)	Rabbits	0.10	83 weeks	No abnormality

*A "day" unit indicates 6-7 hours of exposure. A "week" unit indicates a 5-day period.

tract unabsorbed, whereas the relatively soluble (and ionizable) bichloride is readily absorbed. But so far as we really know, the subsequent action of the minute amount of mercurous chloride actually absorbed may be the same as that of mercury bichloride in a qualitative sense, the observable difference in the damage caused by the two compounds being only a matter of degree consequent upon differences in concentration at the sites of action.[49]

Along this same line, mercury metal may be swallowed safely for the simple reason that for all practical purposes it does not go into solution in the gastrointestinal tract and therefore passes out with the feces; and there is a record of an intravenous injection of several grams of elemental mercury in a case of attempted suicide with no demonstable effect other than collection of the metal in the right side of the heart. Using inhibition of yeast-cell growth as a criterion of toxicity, Sollman[39] examined the relationship between toxicity and the physicochemical properties of simple mercury compounds. He concluded that the amount of anti-yeast activity was correlated with the capacity for ionization. This view was supported by recent experimental observations of Fitzsimmons,[40] who found that toxicity of mercury compounds apparently correlated well with the extent of ionization as measured by a dithizone titrimetric procedure. On the other hand, Rowland[42] was unable to correlate the ionization of organomercurials with their diuretic potency or their toxicity. It is widely accepted today that many potent mercurial diuretics act without being completely ionized,[43] as demonstrated by the high percentage of the injected dose which is eliminated unchanged from the organism.[41] A satisfactory explanation on this basis of the diversified toxic effect of different mercury compounds is not therefore available at this time.[41]

Even so, it can be stated that mercury metabolism in terms of organ localization and subsequent clearance varies markedly with different compounds and that this variation has a great influence upon the resulting clinical picture. There is fragmentary evidence, in human-case experience as well as in animal experiments, that elemental mercury and simple organic compounds (alkyl derivatives) penetrate the blood-brain barrier relatively easily, as a result of which these compounds manifest a certain selectivity in regard to nervous system toxicity.

Individual Susceptibility—For a long time, different observers have mentioned individual susceptibility in connection with the toxic action of mercury. This variable can be explained, at least partly, on the basis of the varying capacity of an organ to bind and thereafter to release circulating mercury. Experiments along this line have utilized both mercurial diuretics and inorganic compounds. Aika and Fitz[36] administered Hg^{203}-tagged diuretics to a series of patients in the agonal state and found less mercury in the kidney tissue of those with organic renal lesions than in those whose kidneys were apparently normal. Rats, which were given intraperitoneal injections of albumin to produce albuminuria, were evidently protected from renal injury by a mercurial diuretic which was subsequently injected.[54] Yagi and White[55] injected $HgCl_2$ into rats that had been maintained on protein deficient diets and found that mercury was bound to different protein moieties in kidney tissue than was the case among control animals. Miller et al.[56] found differences in retention rates of mercury, as high as 3:1, both for phenylmercuric acetate and mercury bichloride, in chicks of different strains. Martin and Reid[57] found more rapid excretion through the urine of injected mercury by hypoproteinemic dogs than by normal animals, and consequent survival of animals treated with doses that were lethal for control dogs. All of these experiments demonstrate that variations in the handling of mercury are dependent upon differences of strain within the same species as well as upon the level of health of the organism under study. Partial evidence, in this respect, may be derived by the observed individual variability of mercury urinary excretion in men exposed to similar air levels. Neal et al.[10] pointed out that persons with clinical evidence of mercurialism excrete, on the average, less mercury than individuals apparently normal and exposed to the same air levels. Whether this phenomenon is a consequence or a factor of intoxication is not clear, and only further investigation can elucidate this problem.

Metabolism of Mercury

Blood—Mercury develops chemical associations with various substances of the blood. Lomholt, as quoted by Sollman,[66] found that the mercury content of the blood following administration of $HgCl_2$ per os was about equally divided between that contained in the serum and that within red blood corpuscles. It has become well-known since the first report of Fildes[58] on the subject that mercury has a selective affinity for the sulfhydryl (-SH) groups of organic compounds. Since such groups abound in the protein moieties of the blood, as well as in some smaller molecules, opportunities for chemical bonding exist for substantial quantities of mercury. Besides this,

there is a varying degree of water solubility for elementary mercury and its compounds[64] and an indication through the work of Hughes[65] that mercury complexes are formed with lipids.

Ashe et al.[34] reported the observation that mercury leaves the blood rather promptly. Although the mechanism of this transfer is not known, one can logically assume that it occurs as a result of passage into the tissues of molecules to which mercury is attached. Small molecules with sulfhydryl groups, such as glutathione, in particular might play an important part in the phenomenon. But there is a difference in the rates at which the transfer occurs, depending in a general way upon the compound of mercury and upon the tissue involved.

Brain—The blood-brain barrier offers various degrees of resistance to the penetration of mercurials. Those which pass most readily are the alkyl mercury compounds. These have the general chemical formula R_1HgR_1, R_2HgR_2, R_1HgR_2, R_1HgX, and R_2HgX, where R_1, for instance, may be the methyl radical, R_2 the ethyl, and X a halogen, a nitrate, or a phosphate. These substances are volatile liquids whose vapors are readily absorbed through the lungs into the blood. Thereafter, they enter brain tissue rather promptly, an effect which is believed to be due to their fat solubility. Elemental mercury absorbed as a vapor in industrial exposures probably passes the blood-brain barrier with less facility, albeit sufficient to produce the well-known central nervous system changes of chronic mercurialism. Mercurial diuretics, on the other hand, do not penetrate the barrier significantly.[35] Their safety in this regard is popularly ascribed to specific chemical characteristics, but at least one other consideration deserves experimental study. This is the possibility that there may be a limit to the *rate* of this penetration which would have the effect of favoring the penetration of mercury absorbed over a prolonged period of time, as in industrial exposures, while penalizing peak concentrations over short periods of time, as is the situation when mercurial diuretics are injected.

Kidney—From here on, the ideas regarding tissue localization are not so clear. The subject as it pertains to the kidney in particular is at the present time one of active investigation and dispute.[45] Irrespective of the mercurial compound involved, there is early and substantial localization of mercury in this organ, most prominently in the proximal convoluted tubules. Differences in views exist as to whether entrance of mercury into these cells is gained from the blood in the peritubular capillaries or by resorption from the glomerular filtrate, with the preponderance of evidence and opinion now in favor of the former. Recent tracer studies employing the radioactive isotope Hg^{203} have established that mercury is deposited also in the cells of the loop of Henle and, to a lesser extent, in the distal convoluted tubules and collecting ducts.[62] No study thus far has revealed mercury deposition in the glomeruli.

Liver—The liver ranks next as an organ in which mercury concentrates.[48] When mercury was experimentally injected intravenously as a chloride in solution in normal saline, a peak concentration developed rapidly in hepatic tissue.[63] With the passage of a few days' time, this level dropped, and the peak of concentration shifted to kidney tissue. When the same preparation of mercury was injected intramuscularly, the liver concentration of mercury was decidedly less, and its level was always lower than that found in the kidney. Liver tissue recovered at autopsy from subjects who received mercurial diuretics usually contains mercury in concentrations that approximate 10% of that found in kidney tissue in the same subjects. It is generally accepted that mercury which is eliminated in the feces gets there principally by way of the bile and from this that a function of the liver is to transfer mercury from blood to bile.[46, 47] The details of this process are unknown.

Intestine—Some mercury is usually found in the bowel wall of experimentally treated animals as well as in human subjects who have had a known parenteral mercury intake. The concentration here is no greater than in tissues generally, viz., muscle tissue. The finding, nevertheless, has been the basis for the belief that mercury may be eliminated from the blood through the intestinal wall and thus contribute to that which is eliminated by way of the feces. The mechanism of mercury excretion through the bowel wall is relied upon further to explain the intestinal disturbances which may follow inhalation. Definitive studies with regard to this presumed excretory route have not been reported.

Quantitative Tissue Concentration of Mercury

The concentration of mercury in various tissues for a long time has been a subject of interest in forensic pathology, and more recently has been actively studied in connection with the fate of mercurial diuretics. There is a poor correlation between the amount of mercury localized in a given tissue and pathological changes. The matter is further complicated by the fact that mercury may be found in impressive concentrations in the tissues of per-

sons with no identifiable intake of this substance. In two series of consecutive autopsies (one of 45 subjects and the other of 117 subjects), comparisons were made between the mercury levels in kidney and liver tissues of subjects who had received mercurial diuretics and those who had no known mercury intake.[23, 24] The ranges of values among treated subjects were 0.94 to 27.0 mg/100 gm in kidney tissue and 0.1 to 2.5 mg/100 gm in liver tissue; among untreated cases the comparable values ranged from (less than) 0.01 to 12 mg for kidney tissue and (less than) 0.01 to 1.7 mg for liver. In none of these was there pathology attributable to mercury. The reported levels of mercury in kidney tissue following suicide by $HgCl_2$ ingestion serve only to confuse the matter further. Admittedly, the analytical technics available before this suicidal agent was replaced by barbiturates were less sensitive than those in use today. In any event, the highest concentrations (in the reports available to this reviewer) found in such cases were 8.12 mg/100 gm of kidney tissue and 4.65 mg/100 gm of liver tissue.[66] There is a somewhat better correlation between mercury level and toxic effect in the brain. The levels in this tissue, taken from cases of $HgCl_2$ suicide, ranged from 0.2 to 0.28 mg/100 gm of brain substance. In fatal cases of poisoning by alkyl mercury (which readily passes the blood-brain barrier), the levels were 0.58 mg,[38] 1.2 mg,[19] and 2.8 mg[37] per 100 gm of tissue. The highest concentration found in animals acutely poisoned with the vapor of elemental mercury was 0.86 mg/100 gm brain tissue.[34]

The "Biochemical Lesion" of Mercury

Since the discovery by Hellerman[59] of the reversible inhibition of certain hydrolytic enzymes exerted by *p*-chloromercuribenzoate (PCMB), mercury in this as well as other forms has been used as an experimental tool by enzymologists. Because of the affinity of mercury for mercaptans (-SH groups), the inhibition of enzymes by mercury compounds has been considered good evidence of the importance of such groups to enzymatic action. But it is now known that mercury has an affinity (although less than for mercaptans) for other organic ligands that figure prominently in the molecular structure of enzymes: amino-, carbonyl-, and hydroxyl-, to name a few. Organic mercurials, even the simple alkyl-mercury derivatives, behave in this manner both in terms of chemical affinity and enzyme inhibition. At low concentrations, mercury binds principally the mercaptans, but at higher concentrations other radicals are involved.[60] Numerous specific enzymes may be inhibited by mercury in in vitro experiments: several pyridine nucleotide and flavin enzymes, other redox enzymes, and hydrolytic enzymes and transferring enzymes, to name a few. Enzyme *systems*, as well, may be inhibited, viz., phenolsulfate conjugation, citrulline phosphorolysis, oxidative mitochondrial phosphorylation, and serine biosynthesis. Reversal of the inhibition caused by mercury can be achieved by the introduction of competing thiols (dimercaprol, glutathione, cysteine) or cyanic acid. The diuretic effect of mercurials has been ascribed to their inhibition of succinic dehydrogenase within kidney cells.[61] Very probably, the ultimate effect of mercury and its compounds is based on the capacity of these substances to inhibit enzymes.[67] But precisely which enzymes are involved and the degree of their involvement in different expressions of intoxication are at present unclear.

Part II, which concludes this Review, will be published in a forthcoming issue.

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THE DEPARTMENT OF INDUSTRIAL HEALTH
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Information relative to admission, fees, living expenses and housing, fellowships, scholarships and student aid will be furnished upon request from the Office of the Director, Institute of Industrial Health, 1630 University Hospital, Ann Arbor, Michigan.

Industrial Medical Association

THE PRESIDENT'S MESSAGE

ROBERT E. ECKARDT, M.D.

THE Industrial Medical Association proudly dedicates this issue of its JOURNAL OF OCCUPATIONAL MEDICINE to our distinguished colleagues who will be attending the XIII International Congress on Occupational Health. This Congress, which will be held at the Waldorf-Astoria Hotel, in New York City, from July 25 to 29, 1960, will attract the leaders in industrial health from all over the world. Here these leaders will convene to exchange ideas and knowledge in this important field.

Physicians, nurses, industrial hygienists, dentists, management, health physicists, labor leaders, rehabilitation workers, all those many disciplines which concern themselves with the health of those who work will meet with but one purpose in mind: to bring new ideas and new enthusiasms to their task of maintaining the health of those who work, and by so doing, help to maintain their productivity.

Our Association is proud that it played an important, although behind the scenes, role in bringing this Congress to the United States for the first time in 50 years. In 1957, our Executive Committee authorized me to convey to the American Delegation in Helsinki our encouragement to them to extend an invitation to the Permanent Commission to hold their 1960 meeting in the United States. This invitation was extended and accepted. The meeting at the end of this month represents the culmination of three years of diligent effort by a host of people to make what appears will be a memorable occasion, both to those of us in the United States acting as hosts, and to those coming from 50 or so other countries, who will be our guests.

In this issue of our JOURNAL, educational and research activities in the occupational health field are presented for the benefit of those who will attend. It is our hope that they will find in this issue ideas which will be useful in training the young men and women who have evidenced interest in this field. There is a heavy responsibility on all of us to see that training opportunities in industrial medicine, industrial hygiene and industrial nursing are available, and of the highest professional caliber. These opportunities must be available at the undergraduate, graduate, and postdoctoral levels. If they are to serve as a stimulus to an independent career in the occupational health field, they must be accompanied by research on the outstanding problems of the field. It is axiomatic that teaching and research go hand in hand in the medical field, for without one the other certainly must dry up.

In this issue Dr. Ashe begins by discussing graduate training for industrial medical practice. Dr. Whitaker continues with a discussion of the essential components of an in-plant training program. Dr. Felton reviews the teaching of occupational medicine in our medical schools. Each of these men, being associated intimately with such programs, is well qualified to speak on his particular topic. As I pointed out in my opening President's Page, if our field is to continue to progress, we shall need many more qualified and interested industrial physicians. It is through training programs such as those outlined by Drs. Ashe, Whitaker, and Felton that these qualified persons are to be obtained. Professor Hatch and Dr. Yingling discuss the training requirements and opportunities for industrial hygienists and industrial nurses. It is these two additional disciplines that round out the triad of professions which are intimately associated with the preventive and constructive aspects of occupational health. Finally, Rigney and Eckardt,

with the cooperation of over 40 persons, have tabulated the research activities going on throughout the country.

We of the IMA are proud to put forth for our distinguished colleagues in occupational health these views of what is required to train people effectively to carry out a progressive occupational health program. We hope that many of them will have the opportunity to visit some of the centers where this exciting training and research are being so vigorously prosecuted. We feel confident that if they do they will come away enthusiastic and stimulated and the time spent will be well worth while. Likewise, we are sure the educators and researchers at these centers will be stimulated by such visits and the exchange of ideas that will result. We hope this issue of our JOURNAL will serve as a reference for those who attend the Congress, and help them over the three intervening years between now and the next Congress to maintain contacts with their colleagues who are interested in training and research in this ever-growing and ever more important field.

Book Reviews

DIGEST OF OFFICIAL ACTIONS, 1846-1958, American Medical Association. Volume I. Susan Crawford, M.A. Price $5.00. Pp. 779. American Medical Association, 535 N. Dearborn St., Chicago 10, Ill., 1959.

The American Medical Association has recently undertaken the compilation and documentation of 112 years of official activity and has published a reference tool, "Digest of Official Actions, 1846-1958"—impressive in scope and historically important. Through the years, the House of Delegates, official policy-making body of the American Medical Association, has considered a wide range of subjects dealing with medicine as an art and a science, the profession and its organization, public health, and the well-being of society. The results of this activity were published originally in the "Official, Proceedings of the House of Delegates" and selectively abstracted in the Organization Section of the *Journal of the American Medical Association.* Two indexes have appeared previously, in 1883 and again in 1942; but this current work is the first publication to present a cumulative approach to all official decisions from the organization's inception to the present time. It is the stated intention of the Association to bring it up to date regularly, thus sustaining usefulness.

The arrangement provides for ease and efficiency of use. Broad topics are arranged alphabetically and supplemented by a very extensive and excellent index indicating more specific categories. It is possible to uncover little-known and obscure facts by judicious use of such a detailed index. Each subject area is arranged chronologically; historical continuity is preserved. This fact has great import for the researcher, since historical sequences give a reader a feeling of the magnitude and importance of a subject and widen his interest. We observe, for example, that the American Medical Association in 1883 first turned its attention to problems concerning the health of the worker and continued its interest with increasing vigor as the years went by.

The reader is referred to the original source of publication of each item; it might be mentioned, however, that in some cases when the material has appeared in both the *Journal of the American Medical Association* and the "Official Proceedings," reference is made only to the latter. This might lessen the value somewhat for those who are seeking more information and who do not have easy access to the "Official Proceedings." Inasmuch as the purpose of the compilation is to digest actions and guide the user in policy formulation, this fact perhaps cannot be labeled a drawback.

The Digest actually achieves its purpose most commendably and should prove informative and useful to those interested in the mechanics of policy formulation, to those working with medical societies at various levels, and to those concerned with administration.

Over and above the fact that this is a significant reference tool, the "Digest of Official Actions" gives one a sense of history as well as a searching look at the many facets of human life and endeavor reached by the American Medical Association.

—RALPH F. SCHNEIDER, M.D.
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NUTRITION AND ATHEROSCLEROSIS. Louis N. Katz, M.D.; Jeremiah Stamler, M.D.; and Ruth Pick, M.D. Price, $5.00. Pp. 146, with 67 illustrations. Lea & Febiger, Washington Sq., Philadelphia 6, Pa., 1958.

The authors have attempted a comprehensive yet succinct analysis of the findings in the welter of atherosclerosis research. Evidence of the relationship of nutrition to atherosclerosis is examined under three headings: (1) evidence from epidemiology; (2) evidence from clinical-pathologic findings; and (3) evidence from animals in the experimental laboratory.

The need to use such descriptive terms as "The Nutritional-Metabolic Cholesterol-Lipid-Lipoprotein Theory of Atherogenesis" does not speak well of the exactness of current knowledge. Katz and his

associates, however, are convinced that the disease is basically a nutritional one and, furthermore, that it is "highly amenable to alteration by dietary means." At one point, atherosclerosis is referred to as being "preventable and (at least up to a point) curable."

There is acceptance of the need for a multifactorial analysis of the cause of atherosclerosis. The influence of nephrosis, hypothyroidism, diabetes mellitus, familial xanthomatosis, hormones, and other factors are included for consideration. The authors consider the common denominator to be nutrition; their basic tenet is that "high-fat, high cholesterol intake is the decisive nutritional aberration in the causation of hypercholesterolemia and atherogenesis."

—LEMUEL C. MCGEE, M.D.
Medical Director
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Wilmington, Del.

SOCIAL PSYCHIATRY AND COMMUNITY ATTITUDES—SEVENTH REPORT OF THE EXPERT COMMITTEE ON MENTAL HEALTH. World Health Organization. Price $0.30. Pp. 40. World Health Organization, Palais des Nations, Geneva Switzerland, 1959.

This booklet is a very useful source of reference for all personnel engaged in rehabilitation efforts for the mentally ill; it is written in clear, straightforward language and contains several sections of immediate interest to the occupational physician and nurse. The introductory section should be very helpful to anyone wishing to clarify in his own mind what is meant by the confusing and often abused term "Social Psychiatry."

The committee discusses the nature and goals of social psychiatry and points out that "the most advanced protagonists of occupational therapy have always insisted that its chief goal is neither to reach a high output of products nor to hold the patient out of harm's way by keeping him busy, but rather to offer him opportunities for social contact which will be beneficial to the adequate development of his personality." Psychiatric progress has gradually led to an enlargement of psychiatric practice; hence the significance of social conditions in the causation of many behavior disorders has been recognized more widely. This crucial step forward requires that the community make a similar movement toward psychiatry. "The psychiatrist is nowadays often able to place a person at the door through which he can step out into normal life, but this action will not have the desired effect if outside that door there is only empty space."

In general, there is a tendency toward increased tolerance for the mentally ill persons among community leaders and employers. Among progressive communities, certain employers will allow patients time off to attend treatment sessions . . . in much the same way as they would for a physical illness.

For the patient, rehabilitation and employment still pose many serious problems. "The long-term patient is coming out into a world that he has forgotten and which, more often than not, has forgotten him." Districts, landmarks, and industries have come and gone, faces have changed, and strange, new customs exist. The patient requires guidance in this unfamiliar world, with its bewildering speed, and, even if his skills are still useful, he will need considerable support and understanding to make a satisfactory adjustment to life. The short-term patient is not free from problems either. His recent breakdown is still vivid in his memory. It may have been dramatic, and his return is feared by the community, his family, and his employers. The patient must be helped to overcome his concern about being rejected and unwanted.

"Social psychiatry is concerned with fitting him into a work environment." While yet in treatment, he will be learning to adjust to employment conditions. When the discharged patient returns to work, he may have to adjust by gradual steps, which implies that those involved are making allowances for his handicap. "In some countries, social organizations and legislation protect the mentally disabled as they do the physically disabled. Thus, in Britain 3% of all places in factories employing more than 20 men are reserved for disabled persons. In the same country, a vast rehabilitation scheme under the Ministry of Labour provides equal opportunities for the mentally disturbed and for physically disabled persons. There are almost one hundred factories for the severely disabled who cannot compete on the open labour market, and the fourteen industrial rehabilitation units run by the Government take many mentally ill patients while they are still in hospital. Rehabilitation of such patients is as satisfactory as in the case of the physically disabled. Similar systems are to be found in many other countries. However, the success of all these measures will in the end depend on the people with whom the more-or-less recovered patient is expected to associate."

Readers in the United States may request copies from Columbia University Press, International Documents Service, 2960 Broadway, New York 27, N.Y.

—KENNETH J. MUNDEN, M.D.
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The Menninger Foundation
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THE HEART: A LAW-MEDICINE PROBLEM. Samuel R. Gerber, M.D., LL.B.; Alan R. Moritz, M.D.; and Oliver Schroeder, Jr., LL.B. Price, not given. Pp. 334. Multi-Stat Copy Company, 1517 Superior Ave., Cleveland 14, Ohio, 1958.

This book is a transcript of an institute on "The Heart: A Law-Medicine Problem," held in Cleveland in March, 1957. The lectures were recorded by machine shorthand and lithographed in book form. As the proceedings of this symposium, it will be of interest to those who attended.

Each of the 12 chapters begins with an outline and closes with the recorded discussion. The re-

productions of visual-aid material are only fair. A glossary replete with inaccuracies and an index complete the text. In each chapter, an eminent authority presents one segment of the program. The organization is ideal, covering anatomy, physiology, pathology, and clinical diseases of the heart. Time restrictions have prevented the essayists from fully developing their assignment. One regrets the oversimplification of descriptive medical terminology, which is further confused by the retention of some technical medical terms left unexplained or inaccurately defined in the glossary.

A lecturer with pauses, inflections, gestures, and visual aids emphasizes and carries his message to an audience. The same message faithfully recorded and reproduced on the printed page fails to have the same charm because to the inflexibility and syntactical regimentation of the written message. Herein lies the error of commission of this record.

This is not a medicolegal text. It is merely an attempt to present certain phases of cardiology. The physician will gain very little from the publication, and the lawyer cannot rely on it as an authoritative text. This reviewer was extremely disappointed that the full potential of this eminent faculty was not utilized. I sincerely hope the material may be reedited and developed into a useful contribution to our literature.

—EUGENE L. WALSH, M.D.
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Information Please

The questions published in this column are edited versions of requests for information that have been received during recent months. The answers have been prepared by one or more competent authorities in the particular area covered by the question. Readers may address questions to the Editor.

QUESTION: *Is there any information concerning the toxicity of zirconium and its industrial hazard?*

ANSWER: Absorption of zirconium from the skin, lungs, or intestinal tract is very limited. Harrison has suggested that 0.01% of an oral dose and 20% of an intraperitoneal dose are absorbed. The studies of Harding and Cochran have indicated a very low order of toxicity of zirconium and its salts by all routes of administration in several animal species. In rats severe prolonged exposure to 25,000 particles (80% of these were less than 1μ in diameter) per cubic centimeter of air from two to six months produced chest x-ray changes similar to those seen in siderosis. No fibrosis has been observed in any organ following zirconium exposure (Schrenk). The LD_{50} for rats given intraperitoneal injections of zirconium salts ranges from 63 mg per kilogram of metal as the sulfate to 426 mg per kilogram of metal as the nitrate. Reed reported on 22 men exposed to zirconium dust in a refining operation. None of these men showed any ill effects from their environment.

A chemical engineer who developed pulmonary granulomatosis was also rather heavily exposed to beryllium, although he was associated with the development of the process for perfection of zirconium. Studies on the use of zirconium in orthopedic surgery and neurosurgery for pins, plates, screws, and clips indicate that this material produces the same or less tissue response as other metals that are now in common use.

QUESTION: *A patient who is an airplane mechanic has had frequent opportunities to encounter hydraulic fluid by skin contact but for short periods. There have been no exposures to vapors in enclosed areas other than fitting the hydraulic systems occasionally while in the plane. His present condition began with an episode of "food poisoning" in the hills of Tennessee while on vacation. Two weeks later he developed progressive weakness in the shoulder girdles but no actual peripheral nerve palsy. Is it possible that he has been intoxicated by contact with the hydraulic fluid which contains TCP?*

ANSWER: Certain hydraulic fluids do contain tricresyl phosphate (TCP) but in small concentrations. A small fraction of this TCP is the ortho form which has been responsible for "Jake" paralysis. It does not appear that occupational exposure could have occurred; however, the possibility of accidental ingestion of TCP while on vacation does exist. The gastrointestinal symptoms and the latent period are suggestive of this route of absorption. Despite these factors however, if TCP were the etiologic agent, there should have been some evidence of peripheral nerve palsy, paralysis, and wasting of muscles, particularly the interossei. Since these were not present, it would be best to look elsewhere for the diagnosis.

QUESTION: *A parachute cleaner after working 20 years on the same job was given a periodic chest film. The results indicated bilateral bullous emphysema of both upper lobes. The solvents used in the cleaning operations have been confined to trichlorethylene for the past eight or more years but probably included carbon tetrachloride prior to 1951. Is it possible that there is a relationship between the bullous pulmonary emphysema and the solvent exposure?*

ANSWER: There is no physiopathological basis for postulating the development of pulmonary emphysema, bullous or otherwise, from exposure to the solvents mentioned or to other commonly used cleaning fluids. Furthermore, in spite of a considerable industrial experience over many years with such fluids, the literature does not contain cases of pulmonary emphysema from such an occupation.

Editorials

How About Health Education?

OUR INDUSTRIAL medical programs are preventive, and we physicians who practice occupational medicine are proud of achieving certification in preventive medicine. Since our field is prevention, even a very minimal program will contain some health education. Health education may be defined as a process of presenting information about health to people in such a way that the recipients are motivated to use this information constantly—to attain and to maintain the best health all the time.

Education of patients occurs in our industrial practices so naturally and casually that neither the physician nor the patient may be aware of its existence. But when health education is not planned so that it is being presented continually, the recipients may not be motivated to make the objectives of health education a way of life and the efficacy of the program remains unknown. Therefore, it would seem just as necessary to plan and evaluate our health education programs as it is to design and appraise our physical examination programs. Why have we not accomplished this?

Safety education has been planned and evaluated for almost 60 years. Industry learned that safety "paid off," and safety is now a highly competitive and incessant program throughout American industry. How did this happen? Did the various industries, corporations, or plants await the reception of a tailor-made program from a central agency? No, the safety engineers decided to teach safety to all their employees from the chairman of the board of of directors to the lowest-paid worker. They used direct person-to-person contacts followed by group and mass approaches. The safety engineers enlisted the aid of supervisors to preach safety. They invented numerous slogans to promote safety. They have made safety a way of life, so that in our generation workers are safer at work than at home. Why have we physicians not emphasized health education to our employees to the same degree that safety education has been emphasized?

The word "doctor" formerly meant "teacher." We physicians are taught to teach, but we have not been meeting our responsibility. If we are awaiting a tailor-made program from one of our national medical organizations with ready-made slogans, report forms, and investigation sheets, we shall probably wait in vain. One national organization of physicians has stated recently that a health education program will not be forthcoming from them. We must employ our initiative. We must invent our own slogans, plan our own programs, and decide how to evaluate our programs.

Before the plant physician teaches the workers, he must teach the leaders of industry that his program is not only needed but wanted. The opportunities to begin are unlimited. American industry has millions of employees who are losing or will lose all of their teeth before the age of 30. Our plants and factories have many workers who have undetected diabetes, and we have more weight per employee than is to be found anywhere else in the world. We have thousands of workers who have never been immunized with tetanus toxoid, smallpox vaccine, or Salk vaccine. We have countless workers who do not have a personal physician. We, the industrial physicians, should be successful in motivating people to accept these elementary ventures. Then why can we not go further and motivate our employees to practice maintenance of good health continuously, resulting in the best of health for all our workers? A program of this kind deserves a place among the many training programs industry now sponsors.

Health education takes planning. Let's begin now!

—Guest Editorial by R. J. SEXTON, M.D.

Abstracts of Current Literature

Dermatology

Percutaneous Absorption of Toxic Substances in Industry. F. D. Malkinson.* A.M.A. Arch. Indust. Health 21:87 (Feb.) 1960. (*Section of Dermatology, Department of Medicine, University of Chicago, Chicago 37, Ill.)

Materials may pass the intact skin by way of epidermis or through the pilosebaceous glands. Absorption is greatly increased in the epidermis that is not intact as a result of abrasions, thermal or chemical burns, inflammatory dermatoses, and excessive perspiration.

Many examples of industrial poisoning resulting from percutaneous absorption of the organic phosphorous compounds, the chlorinated hydrocarbons, the amines, and miscellaneous other materials are presented by the authors. —W.R.B.

Antibacterial Activity of Weak Solutions of Aluminum Salts. I. H. Blank* and R. Dawes. A.M.A. Arch. Dermat. & Syph. 81:565 (April) 1960. (*Dermatological Research Laboratories, Department of Dermatology, Harvard Medical School, Massachusetts General Hospital, Boston 14.)

Aluminum acetate as a wet dressing for the treatment of many skin diseases was first recommended by Burow in 1857. Although its pharmacologic value is usually attributed to its astringent and buffer action, the authors, utilizing modern techniques, studied its antibacterial activity. This activity may well be due to its ability to combine with bacterial proteins and so denature them.

Burow's solution is usually diluted 1:10 for use as a dressing. This solution exerts its greatest antibacterial activity at pH 4.5 on preventing multiplication of coliform bacilli on specially prepared callus. Comparatively speaking, saturated solution of boric acid at pH 4.0 and aluminum chlorhydroxide solution at pH 4.0 exert a similar effect. Potassium permaganate (1:5,000) appears to have no effect on the growth of coliform bacilli. —W.R.B.

Diffuse Alopecia in Women. M. B. Sulzberger,* V. H. Witten, and A. Kopf. A.M.A. Arch. Dermat. & Syph. 81:556 (April) 1960. (*999 Fifth Avenue, New York 28.)

Over the past five years, the authors have noted a sharp increase in diffuse alopecia of the scalp in adult female subjects. Their finding was supported by a questionnaire answered by more than 50 dermatologists in North America. Additional evidence was provided by dermatologists in certain European countries who are also observing an increasing incidence of baldness in women.

Symptoms associated with this hair loss limited to the scalp are spotty or diffuse tenderness, crawling, itching, tingling, burning, and an uncomfortable sense of awareness of the scalp. The degree of baldness ultimately developing seems impossible to predict when the patient is seen early. In no case has it reached the proportion noted with the patterned type of baldness in male subjects. Nothing has been found to date to establish the etiology, pathogenesis, or therapy in this diffuse alopecia noted in women.

Note: No occupational factors have been incriminated. It is well for the occupational physician to be aware of the entity. —W.R.B.

Occurrence of Allergic Disease in Patients with Adrenal Cortical Hypofunction. H. M. Carryer,* D. W. Sherrick, and C. F. Gastineau. J.A.M.A. 172: 1356 (March 26) 1960. (*Section of Medicine, Mayo Clinic and Mayo Foundation, Rochester, Minn.)

For many years, it has been known that hypersensitivity reactions are influenced by an intact, normally functioning adrenal cortex. Four hundred ninety-six patients with adrenal cortical hypofunction (Addison's disease) were included in this study. Of this group, 45 patients had a history or findings suggesting allergic diseases such as hay fever, perennial allergic rhinitis, urticaria, angioedema, or drug reactions. Twenty-seven patients showed either a definite time relationship between the full development of their disease and the onset or aggravation of their allergic disorder or an improvement of their allergic disease as treatment of the adrenal hypofunction was being carried out. Of these 27 patients, 8 were affected with atopic dermatitis, and improvement was noted on taking adrenal extracts. In 18 of the 45 patients, no correlation could be found to exist between their allergy and adrenal cortical hypofunction. Of this group, 10 had atopic dermatitis and 8 had drug reactions. —W.R.B.

Some New Observation on the Biology of the Skin Surface. M. B. Sulzberger* and F. Herrmann. A.M.A. Arch. Dermat. & Syph. 81:235 (Feb.) 1960. (*Chairman, Department of Dermatology and Syphilology, New York University Post-Graduate Medical School, Skin and Cancer Unit, New York University Hospital, New York.)

Selected components of the skin-surface film and epidermal structures are discussed briefly by the authors. "Among these there are the homeostatic mechanisms for maintaining an even body temperature, for regulating the surface pH, for the outward and inward passage of water, for forming an oil-in-water or water-in-oil emulsion, for supplying softening and plasticizing effects upon the surface layers, for preventing excessive microbial growth, for protection against ultraviolet damage and against ingress of harmful agents, living or dead." —W.R.B.

Light Hypersensitivity: A Simplified Office Procedure for Diagnosis of Contact Photodermatitis. W. L. Curwen* and O. F. Jillson. J. Invest. Dermat. 34:207 (March) 1960. (*Hitchcock Clinic, Hanover, N. H.)

Contact photodermatitis, or light hypersensitivity, is of two types. The first, phototoxic, is not based on an allergic mechanism. It is elicited by absorption of specific wavelengths of light and produces an increased sunburn reaction limited sharply to the site of application of phototoxic material. A widely known dermatitis of this type is the so-called "berloque" dermatitis.

The second type, the photoallergic, is presumably based on an allergic mechanism. It may be elicited by any erythema-producing radiation. The reaction on skin may be delayed and not sharply limited to the test site. The skin lesions may be any combination of redness, papules, urticaria, or vesicles.

The paper describes a simple photopatch test procedure that may be used in the office to diagnose photocontact dermatitis. —W.R.B.

Mental Health

Psychiatric Rehabilitation. B. Simon.* J.A.M.A. 171:2098 (Dec. 12) 1959. (*Chairman on Rehabilitation, American Psychiatric Association, Arlington Heights, Mass.)

In an American medical dictionary, psychiatric rehabilitation is defined as "the restoration to useful activity of individuals who have been wounded so as to suffer from physical or emotional disability, such restoration including treatment of the disability and training to fit the individual for occupation in industry." The newer concepts of rehabilitation of the psychiatric patient extend beyond the dictionary definition.

The idea of the therapeutic use of the self is introduced. This applies to all personnel who have a professional relationship with mental patients, whether or not the personnel are practicing psychiatry. This concept includes establishing personal relationships which are designed to meet the patients' needs, enabling him to communicate well with others, and, in general increasing his participation in the social group. The psychiatric hospital has undergone a change so that now it is becoming the "open hospital" and the "therapeutic community." It is concerned with a patient's needs, and it plans for an increasing amount of patient activity and relationships with all categories of personnel.

Rehabilitation includes "every aspect of the treatment of the whole person." This is depicted as covering the following six areas of living: psychological, vocational, family, sociorecreational, educational, and community. There is a continuum from the hospital to the community and from the community to the hospital. There are a number of transitional steps in the patient's return to the community—hospital, night hospital, day hospital, sheltered workshop, halfway house, family care, ex-patient club, after clinics, and community. In other words, "the boundaries between home, community and hospital have blurred."

In his summary, the author states that the community physician will play an important role in "the establishment of the mental hospital as a true community hospital with an open door through which hospital personnel, from the medical staff on, are encouraged to make themselves a part of the community and through which the physicians of the community, psychiatrists and nonpsychiatrists, are encouraged to make themselves a part of the hospital." This is a condensed article, containing important concepts. The physician in industry can play a very crucial role in psychiatric rehabilitation. —G.C.T.

Review of Psychiatric Progress 1959—Occupational Psychiatry. R. T. Collins.* Am. J. Psychiat. 116:608 (Jan.) 1960. (*300 State St., Rochester 4, N.Y.)

The introductory section of this annual review makes reference to the increasing interest in occupational psychiatry. For example, there was a conference of industrial executives and industrial physicians at Lake Logan, N. C., which this year focused on industrial mental health. A survey of the A.P.A. Committee on Occupational Psychiatry reveals that about 200 psychiatrists are currently functioning in some consulting capacity to industry. One of the five main projects for World Mental Health Year 1960 will be "Mental Health and Developing Industrialization." The section on psychiatric programing in industry indicates that at least eight corporations are employing full time psychiatrists in the United States with about 200 companies using psychiatrists on a part-time basis. The section on alcoholism reports on one study which concluded that about 60 or 65% of problem drinkers could be helped by a combination of medical and psychiatric measures and Alcoholics Anonymous. There is an interesting section on foreign reports covering developments in occupational psychiatry in Holland, Great Britain, Yugoslavia, and Czechoslovakia.

Concerning training, the National Association for Mental Health has conducted four regional training institutes on mental health in business and industry in the past year, and the American Management Association has developed lectures on human relations in business. The Executive Committee of the President's Committee on Employment of the Physically Handicapped recently passed a resolution which takes cognizance of the importance of the employment of persons with histories of emotional or behavior problems. —G.C.T.

The Organization Man—as Student. A. P. Dudden.* Personnel J. 38:286 (Jan.) 1960. (*Associate Professor of History, Bryn Mawr College, Bryn Mawr, Pa.)

Abstracts

This article discusses university programs designed to train professional managers. The crux of the problem is that the lower ranks of management require a specialized background whereas the upper management groups require a broader and more general type of background, yet promotion is from the first to the second.

There are many management-training programs designed for the promising middle-management group. There is a description of the Bell System program at the University of Pennsylvania, which began in 1953. The executives chosen for the course average 38 years in age. They exchange the classroom for their office and spend nine months relocated in Philadelphia with their families to take a broad course which includes practical logic, economics, art, music, and social science. Additional programs have also been established at Swarthmore, Dartmouth, and Williams colleges as well as at Northwestern University. Evaluation of the program indicates the executives have acquired a richer background and knowledge in the field of literature, art, and philosophy. There is a certain openmindedness which characterizes the approach and thinking of those who have taken the course. Significantly, the pressure to conform was not lost.

The author concludes with the prediction that courses of this type will increasingly be made available to executives, but he questions whether managers are not already, as a class, so enmeshed in overspecialization and narrow experience as to fail to comprehend their own needs. This is a good outline of an ambitious and well-planned program for the training of executives for one large corporation. —G.C.T.

Psychotherapy. K. E. Appel.* J.A.M.A. 172:1343 (March 26) 1960. (*Department of Psychiatry, University of Pennsylvania, School of Medicine, Philadelphia.)

This article is directed to physicians and surgeons who will be called to do more psychotherapy since the introduction of the new tension-reducing drugs. Psychotherapy is widely misunderstood. It is not simply an exchange of ideas, or having a patient accept or adopt correct notions, or soothing the patient with platitudes, for the goal of psychotherapy is the development or restoration of mental or emotional health. The author defines psychotherapy as helping people handle their feelings, motivations, and behavior more effectively. This indicates the broad nature of psychotherapy and indicates that it is not limited to words, planned rational discussions, reasoning, or argument.

Various psychotherapeutic methods are outlined: (1) ventilation psychotherapy; (2) supportive psychotherapy; (3) manipulative psychotherapy; (4) explanatory psychotherapy; and (5) "dynamic growth psychotherapy." In this paper, he describes the latter type. Growth normally will produce "effectiveness, ability to solve problems, satisfactions and health." This growth is an expanding process, but there may be blocks to this activity which then will produce hostility, anxiety, fear, guilt, and ineffectiveness. Psychotherapy is a collaborative and corrective experience and adventure. —G.C.T.

Experimental Toxicology

Screening of Fluorine-Containing Compounds for Acute Toxicity. F. A. Smith,* W. L. Downs, H. C. Hodge, and E. A. Maynard. Toxicol. & Appl. Pharmacol. 2:54 (Jan.) 1960. (*University of Rochester School of Medicine and Dentistry, New York.)

Using the range-finding procedure of Maynard, the maximum nonlethal and minimum lethal intraperitoneal doses in mice were estimated for 20 organic and 4 inorganic fluorine compounds (also 3 diphosphonic acids that did not contain fluorine). Although the general order of toxicity can be estimated, no data are obtained on delayed effects, skin sensitization, or irritation. All compounds tested had a low order of acute toxicity by this route. —R.E.E.

The Acute Toxicity of Pesticides to Rats. T. B. Gaines.* Toxicol. & Appl. Pharmacol. 2:88 (Jan.) 1960. (*Public Health Service, Department of Health, Education, and Welfare, Savannah, Ga.)

The oral and dermal LD_{50} values of various pesticides—15 chlorinated hydrocarbons, 20 organic P compounds, 2 carbamates, 4 As compounds, and 3 anticoagulant rodenticides—were determined on rats. A comparison of laboratory results and use experience indicates a much closer relationship between the occurrence of occupational poisoning and dermal LD_{50} than with occupational poisoning and oral LD_{50}. This is based on studies of compounds with similar oral toxicity but significantly different dermal toxicity.

Carcinogenic Effect of Hens' Eggs as Part of the Diet of Mice. J. Szepsenwol.* Proc. Soc. Exper. Biol. & Med. 102:748 (Dec.) 1959. (*University of Puerto Rico School of Medicine, San Juan.)

Groups of 16 Strain A mice and Strain T. M. (developed at the School of Tropical Medicine, Puerto Rico, and described as cancer-resistant) were fed one to three hard-boiled eggs daily in a Rockland rat diet; control animals of both strains received unsupplemented diets. In the Strain A group which was fed one egg a day for one month, then two to three eggs daily thereafter, 14 malignancies developed in 11 animals; 2 of 16 controls died of adenocarcinoma of the lungs and an ascites tumor. Twenty malignancies were seen in 14 of 16 Strain A mice fed one egg a day; three controls developed a malignant hepatoma or lung adenocarcinoma. Of the 16 T. M. mice also fed one egg a day, 29 malignancies were found in 15 animals; one control developed lung adenocarcinoma. Among one group of Strain

A mice whose diet was supplemented with pressed cottage cheese only, to determine the over-all effect of high dietary protein on carcinogenesis, one salivary-gland carcinoma and two malignant hepatomas developed. The malignancies in the animals on the egg diets were largely adenocarcinomas of the lungs and leukemia, as determined by white-cell counts, but hepatomas and intestinal lymphosarcomas were also seen in Strain A and intestinal and peribronchial lymphosarcomas and squamous-cell carcinomas of the skin in Strain T. M. The results suggest that high protein levels alone are not responsible for the observed high incidence of malignancies in these experiments. Parenthetically, it is noted that rats eat the egg yoke preferentially and leave most of the white. —R.E.E.

The Physiological Response of Guinea Pigs to Atmospheric Pollutants. M. O. Amdur.* Internat. J. Air Pollution 1:170 (Jan.) 1959. (*Harvard School of Public Health, Boston, Mass.)

Increased pulmonary flow-resistance and an increase in respiration work were used to evaluate the irritation potential of low concentration of formic acid, formaldehyde, acetic acid, and sulfur dioxide (listed in decreasing order of irritation). When exposure time was increased from one to 3 hours, the response to SO_2 continued to increase; the formaldehyde response reached a maximum in one hr. A greater response to SO_2, acetic acid, and formaldehyde was observed when the scrubbing effect of the upper airways was eliminated by tracheotomy. The response to SO_2 and formaldehyde was potentiated when the gases were mixed with inert NaCl aerosol (0.04μ), but no potentiation was observed with similar gas-aerosol mixtures of acetic and formic acids. In all cases, however, the aerosol prolonged the response. As with previous work on sulfuric acid aerosols, NaCl particles of 2.5μ did not potentiate the response to SO_2. The evidence suggests that the increased toxicity of a gas-aerosol mixture is related to the aerosol. —R.E.E.

Effect of Methylcholanthrene on the Respiratory Tract of the White Pekin Duck. R. H. Rigdon.* A.M.A. Arch. Path. 68:578 (Nov.) 1959. (*University of Texas Medical Branch, Galveston.)

Intratracheal injection of a suspension of methylcholanthrene in liquid petrolatum usually causes acute tracheitis in the Pekin duck, and death may result from obstruction by an exudate. (The respiratory tract of this animal is similar in many ways to that of man.) If the condition is not fatal, the treatment may induce squamous metaplasia in the trachea and, later, respiratory obstruction as a result of local proliferation of fibrous tissue or a papilloma within the lumen of the trachea. Tracheal metaplasia does occur in ducks normally and in ducks given only petrolatum, but is seen more frequently in birds treated with the carcinogen in liquid petrolatum. In some tracheas showing metaplasia, infiltration of squamous cells into the underlying stroma also occurs, which suggests neoplasia, although no macroscopic squamous-cell carcinoma has been observed. Methylcholanthrene suspended in water plus Tween 80 (polysorbate 80) produces carcinomas and sarcomas in the lung and air sacs of these ducks. —R.E.E.

Vitamin B_{12} and Carbon Tetrachloride Poisoning. Nutrition Rev. 17:346 (Nov.) 1959.

The literature has been reviewed relative to the reported ameliorating effect of vitamin B_{12} on the hepatic necrosis produced in rats by intraperitoneal injection of CCl_4. There is sufficient contradiction in recently reported work to make it difficult to state whether the vitamin does or does not have a protective effect on the liver when small amounts of CCl_4 are injected. Conclusive evidence has been obtained, however, to indicate that no reduction in hepatoxicity is realized with B_{12} when lethal doses of CCl_4 are injected. It should be emphasized that in all these studies the levels of the vitamin used are in the pharmacologic range and far above daily nutritional requirements. —R.E.E.

Contribution to the Study of the Intoxication by Ozone. R. Bassleer. Acta belg. arte med. et pharm. 111:253 (June) 1958; Militari (Brussels) Air Pollution Control A. Abstr. 5:5 (#2626) (Sept.) 1959.

Albino rats were exposed to ozone at an atmospheric concentration of 60 ppm, which was usually lethal in four to six hours. In the first few minutes of exposure, respiratory movements dropped from 100 to 20-30 a minute; inspirations were irregular; and the animal was immobile. The respiratory rate gradually returned to normal in about two hr. The rate then rose to 150, and in the fourth hour polypnea occurred quickly followed by a slowing of the rate and death by edema of the nasal passages. Cardiac rhythm slowed drastically within the first few minutes of exposure and remained at that level until death. Hemoglobin was diminished early, paralleling bradycardia and bradypnea, then rose to normal as O_2 saturation of the blood increased. Near death, the blood was desaturated. The effects of various drugs on the physiological changes were also studied.

It is concluded that ozone causes changes at the alveoli level but also upsets respiration and cardiac contractions. The similar characteristics of O_3 and O_2 intoxication indicate identical mechanisms. —R.E.E.

Manganese-Iron Antagonism. Nutrition Rev. 17: 349 (Nov.) 1959.

Manganese in the diet of animals has been shown to interfere with regeneration of hemo-

globin. Recent experiments with rabbits and baby pigs have revealed a reversal of this effect by the administration of additional iron. —R.E.E.

Radiation Health

Zinc-65 in Foods. G.K. Murthy,* A.S. Goldin, and J. E. Campbell. Science 130:1255 (Nov. 6) 1959. (*Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.)

Radioactive zinc, Zn^{65}, has been found in small quantities of a wide variety of foods obtained from the local markets serving Cincinnati, Ohio. The highest levels of activity were found in oysters taken from Chesapeake Bay, but none of the food contained sufficient Zn^{65} to constitute a radiological health hazard. Because of the widespread occurrence of small quantities of Zn^{65} in foods, it has been postulated that it has been dispersed by high-altitude fallout. —W.D.N.

An Investigation of the Late Clinical Findings Following Thorotrast (Thorium Dioxide) Administration. W. B. Looney.* Am. J. Roentgenol. 83:163 (Jan.) 1960. (*Radioisotope Laboratory, U. S. Naval Hospital, National Medical Center, Bethesda, Md.)

Thorotrast (thorium dioxide suspension) was used extensively between 1930 and 1945 as a radiographic contract medium for the visualization of liver, spleen, and cerebral arteries. Its use has declined in recent years, partly because of injection site sequelae and partly because of recognition of the radiation dose involved.

Excretion studies have indicated a retention half-time of 400 years or longer, hence, for practical purposes, excretion can be neglected. Almost all of injected thorium dioxide is retained by the liver, spleen, and bone marrow. Shortly after administration, it is mainly diffusely distributed in the reticuloendothelial system. With gradual aggregation, dose nonuniformity increases subsequently. Doses of an average of about 3,500 rads to the liver over 50 years have been estimated, with a range of 700 to 15,000 rads, considering a 1:20 nonuniformity.

The discovery of one and probably two otherwise rare hepatic mesodermal tumors in a series of 35 thorium patients is considered quite significant. —T.S.E.

Radioactivity in Foods. C. L. Comar.* J.A.M.A. 171:1221 (Oct. 31) 1959. (*Veterinary College, Cornell University, Ithaca, N. Y.)

Evaluation of the relative hazards of radioisotopes which can be released from atomic weapons or nonweapon sources and get into food demonstrates that iodine-131, barium-140, strontium-89, strontium-90, and cesium-137 are the most significant. Man acquires these isotopes by various food-chain routes, involving atmosphere, soil, vegetation, cattle, meat products, and milk. Radiochemical analyses have demonstrated that the radioisotope concentrations in milk are below the maximum permissible concentrations recommended by the National Committee on Radiation Protection and Measurements and that the actual concentrations in human tissues are equivalent to very small radiation doses. The possible resumption of weapons tests and the expansion of the peaceful atomic energy program, however, make necessary continuing close supervision of dietary levels of radiosotopes. —T.S.E.

Accidental Radiation Excursion at the Oak Ridge Y-12 Plant—IV: Preliminary Report on Clinical and Laboratory Effects in the Irradiated Employees. G. A. Andrews,* B. W. Sitterson, A. L. Kretchmar, and M. Brucer. Health Physics 2:134 (April) 1959. (*Medical Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn.)

On June 16, 1958, a criticality accident caused doses of about 300 rads to five men. These patients were hospitalized for several weeks following the incident. All had epilation, beginning about the 17th day, and some manifested minor hemorrhagic tendencies in the period of lowest platelet counts. Although antibiotics were not given prophylactically, a few minor episodes of infection necessitated their use in some cases. The peripheral blood and marrow hematology followed a rather characteristic and consistent course. All recovered and are in good health.

Note: This accident is written up in considerably more detail in "The Acute Radiation Syndrome: A Medical Report on the Y-12 Accident June 16, 1958," compiled by Marshall Brucer, April, 1959. Report ORINS-25 is available from Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., $1.00 —T.S.E.

The Application of Cohort Analysis to the Study of Ionizing Radiation and Longevity in Physicians. R. Selster* and P. E. Sartwell. Am. J. Pub. Health 49:1610 (Dec.) 1959. (*The Johns Hopkins University School of Hygiene and Public Health, Baltimore, Md.)

Data were collected on 869 members of the American Roentgen Ray Society and 1,170 members of the American Association of Pathologists and Bacteriologists. With the hypothesis that occupational exposure to ionizing radiation reduces the life expectancy of radiologists and using the AAPB members as controls, a comparison of death rates and causes of death was made between the two groups which were correlated with respect to calendar decade of entry into the respective societies (cohort). The results of the study are of limited confidence because of an unknown radiation dose (estimates of early exposures run as high as 4,000 r), limited numbers of subjects, and possible bias in selection. The results suggest, however, that older radiologists in the early years of the specialty had a higher death rate than the control pathologists and bac-

teriologists. It also appears that the radiologists had a higher incidence of leukemia and the pathologist-bacteriologist group had a higher incidence of tuberculosis. Each disease may be considered to have been a risk of the occupation. —T.S.E.

Atomic Bomb Exposure and the Pregnancies of Biologically Related Parents: A Prospective Study of the Genetic Effects of Ionizing Radiation in Man. W. J. Schull* and J. V. Neel. Am. J. Pub. Health 49:1621 (Dec.) 1959. (*Department of Human Genetics, University of Michigan Medical School, Ann Arbor.)

Following World War II, the Japanese food-ration program allowed certain items for pregnant women, a fact which caused virtually all of them to register and incidentally provided information for the genetic-effects program. During the period 1948-1953, more than 5,000 pregnancies were registered involving parents who were first cousins, first cousins once removed, or second cousins.

Geneticists regard inbred groups as having particular significance, since mutants would have a relatively greater probability of detectable manifestation. Each parent was assigned to a dose group, based on location, probable shielding, and symptoms. The approximate radiation-dose ranges for the five groups were 0, 5-10, 40-80, 100-150, and 200-300 rep. The product of each pregnancy in the study was examined and recorded. Analysis of the data adds to the list of "negative" studies, since the recorded mutation rates are not statistically significant because of the small numbers involved. This is not to say that the study was valueless, however, since each "negative" study helps better define the "critical range," where genetic differences may be found. —T.S.E.

Environmental Physiology

Laboratory Simulation of a Hot Industrial Job to Find Effective Heat Stress and Resulting Physiological Strain. H. S. Belding,* B. A. Hertig, and M. L. Riedesel. Am. Indust. Hyg. A. J. 21:25, 1960. (*Department of Occupational Health, Graduate School of Public Health, University of Pittsburgh, Pittsburgh 13.)

The authors investigated an actual industrial environment in which workers expended heavy effort for short periods while exposed to high radiant heat loads. During the remainder of the work time (80% of the total), both work effort and heat exposure were less.

Calculations based on the heat stress index (HSI) of Belding and Hatch indicated that the total heat load for the job was 2,610 BTU/hr, which would require an equivalent amount of sweat to be evaporated (E_{req}). The capacity of the working atmosphere in question to remove evaporated sweat was limited to 1,990 BTU/hr (E_{max}). This leads to the prediction of excessive heat storage in the body with resulting physiological strain. Workers on the actual job, however, displayed substantially less strain then that predicted.

To test the hypothesis that the HSI as calculated overestimated the radiant heat load, the authors conducted controlled laboratory tests on subjects following a work pattern and a radiant heat exposure simulating that of the actual job. It was found that ordinary work clothing blocked nearly 40% of the impinging radiant heat. Even greater protection was provided by a reflective apron (52%) or a reflective coat (62%). Where evaporation is a limiting factor, however, the benefit derived from the reflective coat is more than offset by its interference with evaporative cooling, resulting after one hour in greater heat strain than when ordinary clothing is worn. The authors suggest that the value derived for radiation and convection in calculating the HSI be multiplied by a factor of 0.6 to account for the protection provided by ordinary work garments. They further recommend that, when possible, actual measurements of heat strain be made in evaluating heat stress in complex thermal environments. —D.M.

Medical Care Administration

Health Education in Industry—Practical Considerations for Actual Programs in Industry. S. S. Lifson.* Am. J. Pub. Health 49:1357 (Oct.) 1959. (*Director, Education and Public Relations, National Tuberculosis Association, New York.

According to estimates, each working day sees 2,000,000 employees away from their jobs because of sickness. Why is it that, despite our great strides in learning how to cope with illness, we have advanced so little in achieving and maintaining reasonably good health? As the author sees it, it is because such a tremendous part of the responsibility rests squarely on each individual. One must both know and do. We must recognize the need for continuous adult education for healthful living.

How much adult health education can industry do? Many plants conduct extensive programs using bulletin-board posters, leaflets, articles in plant newspapers and magazines, films, talks, and exhibits. A good medical department can do a great deal of educating when employees visit the health facility. Foreman and supervisors can tell when an employee is troubled or is not his usual self and may get him to avail himself of available medical service. Employers can invite community health agencies to come into the plant and put on programs. Such a program should be planned with the help of a representative group from within the plant.

The real responsibility for health education of our citizens rests with the community, with the official agencies, with voluntary agencies, and with all responsible leaders. Both industry and

labor unions regard themselves as part of this responsible leadership. The full benefit of the tremendous strides medical science has made will not be available until each of us has been educated to know and practice the rules by which we can carry out our responsibility for our own health, that of our families, and that of the community. —A.B.

The Role of the Psychiatrist in a Prepaid Group Medical Program. L. L. Tureen.* Am. J. Pub. Health 49:1373 (Oct.) 1959. (*Neuropsychiatric Section of the St. Louis Labor Health Institute, St. Louis, Mo.)

The St. Louis Labor Health Institute provides medical care through a voluntary prepaid medical-service plan serving more than 15,000 eligible members. Approximately 50 physicians and dentists are employed part-time on salary. Within a year after it was organized in 1945, a psychiatrist was employed, initially for a two-hour period each week. Currently, three psychiatrists provide service for 20 hours a week. The LHI operates its own hospitalization plan with benefits more liberal than those offered by Blue Cross. Psychiatric patients receive one month's hospitalization. Patients are generally referred by other physicians, although some are self-referred. Most psychiatric patients do not absent themselves from work; very few are hospitalized.

The psychiatrist functions as a member of a medical team working closely with other physicians, thus affording an opportunity for mutual education among the various doctors. An incidence of 6.6% of emotional illness within the total patient load was estabilished in 1957. Psychiatric services have been made available to a socioeconomic group, Local 688 of the Teamsters Union, primarily semiskilled workers in warehousing or light-manufacturing plants, which ordinarily could not avail itself of such service in private practice. —A.B.

Medical Practice, Medical Care and Modern Society. M. S. M. Watts.* J.A.M.A. 171:1315 (Nov. 7) 1959. (*Chairman, Public Relations Committee, California Medical Association, and Assistant Dean, University of California, School of Medicine, San Francisco)

The problems of medical practice, medical care, and modern society bring us face to face with some of the most complex problems of our times. The devaluation of the dollar, together with rising taxes during the last 25 years, has made it almost impossible for the average person to save adequately to meet the modern cost of serious illness. Many people have come to consider medical care to be simply a product or commodity consisting of diagnostic procedures, x-rays, laboratory tests, operations, pills injections, etc. Others have come to believe that medical care is, in fact, a precise science which could almost guarantee health for all if it could only be made available to everyone. It is believed by many that medical care should be free. The fallacy is obvious; It must ultimately be paid for by the ultimate consumer—the patient.

If it is agreed that only the best in medical care can be satisfactory for Americans, then medical care must be personalized and individualized and the dignity of the human being maintained. The patient's special and particular need for medical care must be recognized. Historically, the medical profession has served under every kind of political, social, and economic system. Its goal continues to be the best medical care for the patient. Experience in California shows that it is possible to develop successful programs that will interfere but little with the traditional relationship between doctor and patient. —A.B.

Surgery

The Positive Approach to Chronic Osteomyelitis. D. E. Rowling.* J. Bone & Joint Surg. 41-B:681 (Nov.) 1959. (Kirkcaldy, Scotland)

Rowling suggests the following program of therapy for chronic osteomyelitis with draining sinuses: The wound is cultured, and therapy with the appropriate antibiotic is begun. The patient is fed a diet rich in protein and vitamins. Laboratory studies are done to exclude anemia, chronic nephritis, diabetes, or amyloid disease. After this medical work-up, operation is performed.

The aim of surgery is to remove all scarred and devitalized tissue. The technique of operation is well described. From the depths of the wound a new culture is obtained and additional antibiotics are given later if additional bacterial types are found. If a large dead space exists, a muscle graft is used. If skin closure is not possible easily, a rotation or pedicle graft is used, for split thickness grafts are not so satisfactory.

After surgery the extremity is placed in a cast and elevated. Dressings are not changed for two weeks unless purulent drainage occurs. If much bone is removed, a weight-relieving caliper is used until x-ray films show adequate bone strength.

In this series of 58 patients, 48 are now free of infection in follow-up periods ranging from one to seven years. There has been recurrence of infection and failure in 10 patients. —O.E.M.

The Three Types of Acute Hematogenous Osteomyelitis: A Clinical and Vascular Study. J. Trueta.* J. Bone & Joint Surg. 41-B:671 (Nov.) 1959. (Oxford, England)

Trueta notes that acute hematogenous osteomyelitis has different pathogeneses and effects in infants under 1 year of age, in children 1 to 16 years, and in adults, more than 16 years. Differences in the vascular supply at these three different age levels explain the difference in the effect of the disease. In children, the nutrient artery

enters in the midportion of the metaphysis and branches. The branches run distalward to the region of the epiphyseal cartilage, which serves as a block. Here the blood flow slows, and it is at this point that the coagulase-positive Staphylococcus aureus finds its ideal medium for growth. In this age group the toxemia may prove fatal. It seldom causes permanent growth damage, as the epiphysis is not involved. In infants, the perichondral vessels enter and progress distalward to the two cartilaginous epiphyseal ends of the bones. They are close to the surface of the epiphysis. This explains the frequency of infections of the joint and of the epiphysis in the infant. In the infant the bacteria is most commonly a streptococcus.

True hematogenous osteomyelitis is rare in the adult. As the linear growth of long bone ceases, metaphyseal vessels cross into the epiphysis connecting it to the metaphysis. From then on blood in the nutrient artery reaches the surface of the epiphysis through large anastamoses; thus bacteria penetrating the nutrient artery may be brought to the vascular loops under the articular cartilage and spread the infection to the joint. The periosteum of the adult is held firmly to the cortex by fibrous tissue, which prevents formation of subperiosteal abscesses and preserves the blood supply of the outer half of the cortex. Thus large sequestra do not form. Instead, there is progressive cortical absorption, which may cause fracture. Also the infection may cause chronic infection of the marrow. The reparative capacity of bone is less after the fusion of the epiphysis.

—O.E.M.

Wound Debridement. N. W. Hoover* and J. C. Ivins. A.M.A. Arch. Surg. 79:13 (Nov.) 1959. (*The Mayo Foundation, Rochester, Minn.)

The authors review the basic issues in the care of the traumatic wound, namely, wound debridement and the principles of wound healing. They emphasize that the objectives of debridement are enlargement of the wound, total exploration, sharp aseptic excision of all tissue which is devitalized or in jeopardy, removal of accessible foreign material, adequate hemostasis, and thorough irrigation of the wound with copious quantities of isotonic saline.

Various tissues give evidence of variable tolerance to destructive force. Because it is elastic and vascular, skin will tolerate a considerable insult and will therefore survive except for a narrow margin about the wound. Subcutaneous tissue tolerates trauma poorly and must be more widely removed. Muscle is most vulnerable, being extensively devitalized by injury. Tendons, fascia, and nerves are highly resistant to trauma.

It is now unjustifiable to sacrifice any major vascular channel which conceivably can be reconstructed. Many failures after arterial repair in trauma are the results of venous inadequacy. When a major concomitant vein also is damaged, continuity of the vein should be restored.

Abstracts

The authors believe that enzymes, used properly, will become important adjuncts in the management of infected and necrotic wounds but emphasize that they never will be substitutes for surgical debridement. —R.J.T.

Stored Skin Homografts. J. M. Young* and G. W. Hyatt. A.M.A. Arch. Surg. 80:40 (Feb.) 1960. (*Naval Medical School, Bethesda 14, Md.)

This report of 50 extensively burned patients treated with stored split-thickness skin homografts is a result of a clinical research effort which began in 1951 at the Naval Medical School. The clinical results indicate that the stored skin homograft may result in the saving of significant numbers of lives when used in the treatment of a burn of 30% or more extent. The 1 to 16-year age group presented the greatest saving in that about one-half of those who might be expected to die by the nature and extent of their burns did not do so.

Stored viable and nonviable skin homografts fulfill the functions of a biologic dressing in extensively burned patients in a manner which compares favorably with fresh skin homografts. Split-thickness skin homografts may be preserved in a viable state for periods of time up to six weeks in nutrient media. Skin which has been impregnated with glycerin, quick-frozen, and store at -60° or -76° C is theoretically viable for a period of approximately one year. Freeze-dried skin in nonviable. A significant advantage is that it can be stored at room temperature and theoretically is usable after being stored five years or more. In addition, freeze-dried skin may be safely and easily shipped for long distances.

The authors emphasize that homografting, although done repeatedly on some of their patients with no obvious deleterious effects or allergic phenomenon reported, should not be undertaken without serious consideration. The apparent risk of mortality of a 30% or less body burn is low, and therefore homografting should be reserved for cases having more than 30% body burns. —R.J.T.

Evaluation of Human Fibrinolysin (Actase). A. P. Fletcher,* N. Alkjaersig, W. D. Sawyer, S. Sherry. J.A.M.A. 172:86 (Feb. 27) 1960. (*600 S. Kingshighway, St. Louis 10, Mo.)

The aim in the development of fibrinolytic agents for the therapy of thromboembolic disease is to induce in the plasma of patients an enhanced thrombolytic activity which can be sustained, without hazard, for long enough periods to effect the resolution of obstructing thrombi. Recent evidence indicates that this desired state can be more readily accomplished with plasminogen activators than with plasmin (fibrinolysin). That fibrinolytic agents introduced for clinical us may not prove active in vivo is illustrated by studies on human fibrinolysin (Actase).

The authors' tests in vitro estimated the com-

ponents of the plasminogen-plasmin and the coagulation system, and the results led to the expectation that the preparation would be ineffective as a thrombolytic agent in man. —R.J.T.

Clinical Toxicology

Pneumoconiosis in Carbon Electrode Makers. A. J. Watson, J. Black, A. T. Doig, and G. Nagelschmidt. Brit. J. Indust. Med., 16:274 (Oct.) 1959.

Dust produced during the manufacture of carbon electrodes, when breathed over a long period of time, is capable of producing a pneumoconiosis that cannot be distinguished from coalworker's pneumoconiosis.

Carbon electrodes are made principally from a mixture of coke, anthracite, and some scrap electrode material, all of which are crushed, milled, sieved, and mixed with hot pitch. They are then shaped and baked, and, finally, their surfaces are finished by hand or pneumatic tools.

Fifteen workmen who had been employed for 10 or more years on the process were examined. Nine case of pneumoconiosis were found; of these, five were designated as simple pneumoconiosis and the other four were of the complicated variety. Theories relative to the etiology of the disease process are discussed. The article is illustrated well with chest x-ray reproductions, photographs of gross and microscopic pathologic material, and contains tables that are concerned with lung dust analyses and other characteristics.

—L.H.M.

Arsenic Toxicology and Biochemistry. B. L. Vallee,* D. D. Ulmer, and W. E. C. Wacker. A.MA. Arch. Indust. Health 21:132 (Feb.) 1960. (*Peter Bent Brigham Hospital, 721 Huntington Ave., Boston)

Besides the toxicologic aspects of arsenic, this review describes briefly the distribution of arsenic in nature, commercial, and medicinal uses, chemical properties, methods of analysis, its presence in the environment of man, and its role in nutrition.

Early work produced evidence that indicated that organic arsenicals are toxic when the arsenic is present in the trivalent state. Later it was shown that arsenic could combine chemically with sulfhydryl groups and that toxic reactions produced by trivalent arsenicals could be reversed by reduced thiol compounds. This knowledge ultimately led to the discovery and use of dimercaprol (BAL) as a specific antidote. Other agents, such as ascorbic acid and *p*-aminobenzoic acid, have been shown to interfere with the cytotoxic action of certain arsenicals in specific reaction systems.

After parenteral administration much of the arsenic is eliminated rapidly in the urine in 24 to 48 hours and more slowly for 7 to 10 days thereafter. It is concentrated in the liver, kidney, lungs, spleen, and skin during the first 24 hours. Very small quantities are found in the brain, heart, and uterus, and low concentrations are also found in bone and muscle. Apparently, highly toxic compounds are bound rapidly and firmly in the liver and kidney and are excreted more slowly than the less toxic and less firmly bound compounds. Accumulations in ectodermal tissue occur with repeated exposure.

In patients who recover from acute intoxication from solid arsenic, complications of encephalitis, myelitis, nephritis, or dermatitis may develop. Peripheral and central nervous system signs and symptoms as well as a host of other changes have been reported in cases of chronic arsenicalism. In industry, the primary toxicologic hazards are contact dermatitis and mucous membrane irritation.

The relationship between arsenic and cancer is discussed. It is concluded that arsenic may be a factor in predisposition to skin cancer in some instances, but that there is no valid basis for assuming that the element plays any role in causing other types of carcinoma. —L.H.M.

Occupational Dieldrin Poisoning: Report of the Committee on Toxicology of the American Medical Association (B. E. Conley, Secretary). J.A.M.A. 172:2077 (April 30) 1960.

This report of the Committee on Toxicology of the American Medical Association is primarily a review of occupational dieldrin intoxication in man, but includes in addition, a report of a fatal case of acute dieldrin poisoning in a 9-month-old child. The review includes technical data concerning the chemical composition of dieldrin and the formulations in which it is marketed.

The amount of quantitative information on the toxicity of dieldrin for man is scanty. Untoward symptoms have occurred after oral doses as low as 10 mg per kilogram of body weight. Dieldrin is absorbed through the skin as well as the respiratory and gastrointestinal tracts. It has been assumed commonly that respiratory exposure is the major source of occupational exposure in man, but in some circumstances dermal exposure is the greatest hazard. The clinical illness associated with dieldrin intoxication is classified into three levels of severity: Mild intoxication is characterized by headache, blurred vision, dizziness, nausea, and psychic disturbances. The intermediate level of illness may involve, in addition to the above symptoms, jerking motions of muscle groups. Severe intoxication produces epileptiform convulsions with loss of consciousness but without incontinence of feces or urine. Laboratory methods are not available for the measuring of dieldrin in biological fluids, although a method is available for the measurement of dieldrin in fat. Electroencephalography may be helpful in establishing the diagnosis of dieldrin intoxication. Treatment of dieldrin intoxication is discussed, and includes washing of contaminated skin areas, gastric lavage where dieldrin has been ingested, and use of

phenobarbital to control central nervous system excitation. The fatal case of dieldrin poisoning included in this report involved the accidental ingestion of an unknown quantity of a powdered insecticide containing 4% of dieldrin. —A.D.

The Use of Peritoneal Dialysis in Acute Methyl Alcohol Poisoning. B. J. Stinebaugh.* A.M.A. Arch. Int. Med. 105:613 (April) 1960. (*Medical Service, Gorgas Hospital, Ancon, Canal Zone)

This report describes three cases of methyl alcohol poisoning treated with alkalinization and peritoneal dialysis. Two of the patients were known to have ingested paint thinner, but the source of methanol in the third case was not known. All the patients were in profound acidosis when seen, and sodium bicarbonate was administered in large doses over periods of several hours. In addition, all three patients were treated with noncontinuous peritoneal dialysis, the details of which are described in the report. Two of the patients survived the acute intoxication but remained blind, while the third died 10 hours after admission. The report includes a review of the therapy of methanol intoxication with a discussion of the rationale for the use of ethanol in addition to alkalinization and dialysis in the in the treatment of methanol poisoning. —A.D.

Internal Medicine

A Hydrostatic Pressure Stocking for the Treatment of Ulcers due to Chronic Venous Insufficiency. J. E. Wood.* Circulation 20:1043 (Dec.) 1959. (*Department of Medicine, Boston University and Massachusetts Memorial Hospitals, Boston, Mass.)

Chronic insufficiency of the venous system of the legs with resulting superficial ulceration of the skin is often a recurring cause of employee disability. Heretofore successful treatment of this condition required prolonged bed rest with elevation of the extremity. While surgery may sometimes remedy the underlying defect, the latter may be too extensive for a permanent cure to be effected. Attempts at applying external counterpressure by means of elastic bandages, elastic stockings, etc., are often complicated by the difference in pressure needed when the patient walks, stands, or sits.

The author describes a method whereby a watertight elastic bladder is incorporated into the medial surface of an adjustable zippered nylon-cotton stocking. This bladder is connected by two flexible tubes to another, smaller, watertight bladder suspended under the ipsilateral axilla at heart level. The system is completely filled with about 750 cc of water and sealed. Hydrostatic pressure equal to that in the venous system is thus applied continuously over the ulcerated area irrespective of the position of the patient.

Ten patients studied showed rapid complete healing of their leg ulcers while carrying on their usual occupational activities. In some, subsequent surgery led to permanent improvement. In others, in whom all forms of surgical treatment had been exhausted, the method was successful in keeping the ulcer healed for periods up to two and one-half years. —J.J.T.

Hypocholesteremic Effect of Benzmalecene. I. H. Page* and R. E. Schneckloth. Circulation 20:1075 (Dec.) 1959. (Research Division of the Cleveland Clinic Foundation, Cleveland, Ohio)

Attempts at prevention of atherosclerosis have recently been directed at preventing hyperlipemia and hypercholesteremia. One method studied by a number of workers involves the use of agents which suppress the synthesis of cholesterol. Benzmalecene, a derivative of the monoamide of maleic acid, was found to be highly effective in reducing plasma cholesterol levels in dogs and inhibiting the production of hypercholesteremia in rats and chickens.

The present study reports the trial of Benzmalecene in 19 patients for periods up to four months. The drug was given by mouth in doses of 250 mg two to four times a day after meals, the average dose being 750 mg. Ten out of twelve hypertensive patients and seven hypercholesteremic patients so treated showed a significant decrease in plasma cholesterol levels. More than 20% of the patients could not tolerate the drugs for long periods because of nausea, epigastric discomfort, and diarrhea. Twelve patients tolerating the drug for two to four months had liver-function tests by means of sulfobromophthalein sodium (bromsulfalein BSP) dye-retention tests and serum alkaline-phosphatase determinations. Although none showed abnormalities in phosphatase levels, 8 of 12 demonstrated abnormal dye retention.

The authors emphasize the need for prolonged animal testing and rigidly controlled studies in selected patients before such cholesterol-inhibiting drugs are released for general use in the prevention of atherosclerosis. —J.J.T.

The Skin-Surface-Glucose Test. D. I. Miller* and A. S. Ridolfo. Diabetes 9:48 (Jan.-Feb.) 1960. (*Department of Medicine, Sinai Hospital, Baltimore, Md.)

Patients using glucose oxidase test paper for the detection of glycosuria reported positive reactions on strips merely held between their fingers. Evaluation had led the authors to the conclusion that such a positive test indicates that the blood glucose is or has recently been elevated. In the course of their observations, the authors found previously unsuspected diabetes among their control group. The cortisone-glucose tolerance test was required to confirm

the probable presence of diabetes in two instances. —L.W.

Insulin and Pinocytosis. E. G. Ball* and R. J. Barrnett. Diabetes 9:70 (Jan.-Feb.) 1960. (Harvard Medical School, Cambridge 15, Mass.)

Pinocytosis, or "cell drinking," has been observed in both unicellular organisms and individual mammalian cells. The process resembles phagocytosis except that only liquid is observed to enter the cell.

Recent in vitro observations of epididymal adipose tissue of rats suggests that insulin stimulates pinocytosis. Concomitantly, glucose is taken into the cell and converted to fat. This is in keeping with the earlier suggestion that insulin may act by enhancing the entrance of hexoses into cells. —L.W.

A Clinical Aphorism in the Diagnosis of Multiple Sclerosis. F. R. Ferguson* and L. A. Liversedge. Lancet I:1159 (June 6) 1959. (*University of Manchester, Manchester, England.)

Multiple sclerosis, unless presenting as a classical case with widespread involvement and a history of remissions, frequently taxes the ingenuity of the most alert physician. Diagnostic problems arise particularly in those patients complaining of symptoms in one limb and of mild sphincter disturbance. In such a patient, one must eliminate the possibility of a space-occupying lesion of the brain or spinal cord.

The authors have observed that in patients with multiple sclerosis clinical signs outstrip symptoms. For example, the patient may complain of symptoms in one leg only, and yet signs of *bilateral* pyramid-tract involvement are present. Thirty such patients have been seen by the authors, and the diagnosis of multiple sclerosis has been proved correct in all. The diagnosis of multiple sclerosis is not justified, however, in the presence of clinical signs, even though pyramidal, but in the absence of symptoms. This latter point is illustrated by great-toe extension occurring normally in old age, without other signs of pyramidal disease.

The authors have applied the term "aphoristic multiple sclerosis" to those patients complaining of symptoms in one limb, categorically denying symptoms in the other, but showing positive signs of pyramidal involvement in both. —S.H.S.

Obstructive Emphysema in Cigarette Smokers. A. L. Flick* and R. R. Paton. A.M.A. Arch. Int. Med. 104:518 (Oct.) 1959. (*Kings County Hospital, 325 Ninth Ave., Brooklyn, N. Y.)

Detailed smoking histories and maximum expiratory-flow (MEF) rates were recorded on 222 male hospital patients devoid of cardiac, pulmonary, or acute disease. The MEF rates were remarkably constant for nonsmokers up to age 70, but for smokers progressive decrease in the MEF with increasing age began at about 35 years of age. The number of cigarettes and the extent to which they were smoked seemed to correlate with the reduction of the MEF. —L.W.

Industrial Hygiene

Evaluating Hot Environments. R. F. Scherberger.* Indust. Med. & Surg. 29:16 (Jan.) 1960. (*Laboratory of Industrial Medicine, Eastman Kodak Co., Rochester, N. Y.)

This article reviews the heat-stress evaluation techniques developed by Hatch and others, and it presents an application of such techniques to an actual work situation. The formulas for determining full heat load and other environmental factors involve certain assumptions and should therefore be applied with caution.

Two interesting concepts are developed. A maximum hourly sweat rate is assumed, and the heat which this will dissipate is calculated. The ratio of evaporative capacity required to maintain body-heat balance to the evaporative capacity of the environment is called the Heat Strain Index. Where they are equal, the index is 100 on the maximum for an eight-hour day. A lower index is considered safe; a higher one would be excessive. In a similar fashion, a Recovery Time Ratio is developed which gives an indication of recovery time necessary in a cool rest area after exposure to excessive heat. —M.K.

Glass Dust: A Study of Its Biological Effects. P. Gross,* M. L. Westrick, and J. M. McNerney. A.M.A. Arch. Indust. Health 21:10 (Jan.) 1960. (*Industrial Hygiene Foundation, Mellon Institute)

The biological effects of glass dust upon the eyes, gastrointestinal tracts, and lungs of experimental animals were studied. The principal constituents of the glass used in the investigation were SiO_2 and oxides of Al, Ca, Mg, and B. Na, K, Ti, Fe, and Zr were present in amounts less than 1% but usually more than the traces in which F was present. Flakes of glass were specially processed to produce a very fine dust.

The conjunctivas of albino rats were dusted with particles ranging from 50 to 4,000 microns. No effects were demonstrable.

White rats were fed dust, but no toxic or traumatic effects were observed in the gastrointestinal tracts of the animals. Their growth rate diminished slightly owing to the fact that their food intake was reduced by the volume of glass ingested.

Guinea pigs and rats exposed to fine dust for a year and rats to which dust was administered intertracheally showed only minimal pulmonary changes, which were limited to the formation of small focal alveolar-dust collections. No fibrosis was seen. Focal intracellular glass-dust deposits, not associated with fibrosis, were observed in the pulmonary lymph nodes.

"Coarse glass dust injected into the lungs of rats behaved like inert foreign material and was associated with minimal foreign body reaction without significant collagen formation." —M.K.

Toxicity of Propellant Fuels and Oxidizers. D. B. Dill* and K. H. Jacobson. U.S. Armed Forces M. J. 11:125 (Feb.) 1960. (*Army Chemical Center, Md.)

Dill and Jacobson identify some important propellants and oxidizers and summarize their findings concerning the toxic effects of these compounds as observed in experiments with animals. The most striking effect of chronic poisoning by hydrazine is fatty degeneration of the liver; in addition, focal interstitial nephritis, anorexia, weight loss, and terminal convulsions were seen in animals repeatedly exposed to hydrazine vapor. Evidence is available that the "methylation of hydrazine accentuates the central stimulating effects of the hydrazine moiety, but reduces the metabolic effects in terms of liver and blood changes." Chronic poisoning due to 1,1,-dimethylhydrazine (UDMH) causes anemia. Chlorine trifluoride, fluorine, red fuming nitric acid, and nitrogen tetroxide or nitrogen dioxide and ozone are mentioned as propellant oxidizers having highly irritating qualities. The low threshold limit values as established by the ACGIH are tabulated.

The authors note the current importance of fuels containing boron and hydrogen. The hazards associated with these elements are highlighted. The newer boron fuels, identified as HEF-2, HEF-3, and Hi Cal-3, like those known as pentaborane (B_5H_9) and decaborane ($B_{10}H_{14}$), can alter nervous, cardiovascular, and metabolic functions as demonstrated in experiments with animals. The degree of toxicity of the newer fuels is given in a table. Large doses produce tremors and convulsions; small doses act as depressants. Blood pressure of animals to which these fuels had been administered first increased and then decreased. Death followed. Hyperglycemia was seen in the experimental animals, but the significance of this is not yet well understood. The rate and amplitude of cardiac contraction was noted as having increased in some isolated rabbit hearts perfused with HEF-3. Attempts to reverse this effect have not been successful. HEF-3, administered into the veins and peritoneal cavities of cats, rabbits, and rats, often causes pulmonary edema or hemorrhage. —M.K.

Use of a Gas Chamber for Testing Air Samplers. R. O. McCaldin,* and E. R. Hendrickson. Am. Indust. Hyg. A. J. 20:509 (Dec.) 1959. (*Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.)

This report covers some of the uses and problems associated with evaluation of air-sampling instruments by use of a test chamber. In this case, the chamber was a 6 ft cube, with a volume of 216 cu ft (6.12 cubic meters); which was evaluated with respect to its ability to retain different gases. The results are reported for the effects of leakage, surface losses, and decay rates on test concentrations. Perhaps the most important observation reported in this paper was the fact that the experimental concentration was uniformily less than the theoretic concentration based on the size of the chamber and the quantity of contaminant injected. That the reduction in experimental concentration could be due to adsorption of the test gas on the walls of the chamber was tested by increasing the surface area approximately 50% and observing that this produced the anticipated effect on the measured concentrations in the gas chamber. An equation is given which permits the estimation of this factor. —E.C.R.

Noise and Hearing

Effect of Environment on Noise Criteria. T. F. W. Embleton,* I. R. Dagg, and G. J. Thiessen. Noise Control 5:369 (Nov.) 1959. (*National Research Council, Ottawa, Ontario, Canada.)

An acoustic survey was made of offices of the Canadian Civil Service where the occupants had previously complained about work conditions. Specific complaints about noise had not been made in all offices. All but one office were engaged in data processing using punch-card machines. In this unique office, a check-preparation machine and a graphotype-printing machine were operated. The highest octave-band noise levels for nine offices are 20 to 75-cps band, 71 db; 75 to 150-cps band, 76 db; 150 to 300-cps band, 77 db; 300 to 600-cps band, 75 db; 600 to 1,200-cps band, 74 db; 1200 to 2400-cps band, 73 db; 2400 to 4800-cps band, 68 db; and 4800 to 9600-cps band, 64 db. The lowest level for each of these octave bands was about 10 db lower. The data were compared with Beranek's noise-criterion curves and with his criteria of NC-50 to NC-55 for acceptable levels in offices. Persons working in these offices rated the acceptability of the noise conditions, with respect to satisfactoriness for doing required work, in the same way that Beranek's office workers did. In many cases, the findings from this survey are in agreement with Beranek's findings; however, deviations were found and because of these, the authors recommend a modification to the noise-criterion curves to permit noise levels 5 to 10 NC-units higher. The interesting and important aspect is that these increased noise levels which are acceptable to the worker require specific control of certain physical aspects of the office space. The important factors are that (1) all chief noise sources must be of the same type and be within the room; (2) acoustical absorption on all parallel walls and on the floor and ceiling must be very good; (3) no scattering or reflecting objects (book cases, file cabinets, etc.) can be present

in the room; (4) the ceiling height must be appropriate; and (5) the principal horizontal dimensions of the room should have a ratio not greater than 1.6 to 1, and the larger dimension should not exceed 50 to 60 feet. These findings stress the importance of nonacoustical factors in determining man's rating of an office or other work space with respect to noise conditions that are compatible with the work to be accomplished. —H.O.P.

Statistical Measurement of Factory Noise. G. G. Sacerdote.* Noise Control 5:361 (Nov.) 1959. (*Istituto Elettrotecnico Nazionale, Torino, Italy.)

The author considers the problem of measuring and specifying noise conditions in factories where the noise levels are not steady. A single number, expressing the maximum level, rates the factory as excessively noisy, whereas the use of the mean-noise level does not take account of short, high-level noise peaks that may damage the ear. He illustrates, by an example, the use of a cumulative distribution of noise levels to more clearly define the noise conditions. The data are expressed as percentage of total time the noise equals or exceeds a specific level. In the example, the C-scale noise level ranged from 70 db to 98 db. The noise level equalled or exceeded 70 db 100% of the time. It exceeded 74 db about 99% of the time and exceeded 74 db about 96% of the time. Noise level was equal to or in excess of 84 db 50% of the time, whereas it equalled or exceeded 86 db only about 28% of the time and exceeded 90 db only 4% of the time. Levels of 96 db and 98 db were exceeded less than 1% of the time. The same information may be given in a different way. The author selects 4-db noise-level increments and shows the percentage of time the noise levels fall within each of these steps. In the sample, the noise level ranged between 82 and 86 db 45% of the time. It was in the range 78 to 82 db 25% of the time and was in the range 86 to 90 db about 27% of the time. The level was in the range 90 to 94 db about 7% of the time. Higher levels were found less than 1% of the time. The primary purpose of the author was to design a relatively simple instrument, for use with a sound-level meter, to describe noise levels in the statistical manner described. He gives a general description of an instrument that measures the percentages of time that noise levels exceed 78, 82, or 86 db. The author also discusses limits for damage to the ear, for annoyance, and for satisfactory working efficiency. He states his limits in terms of C-scale noise levels in contrast to the U.S. method of expressing noise levels in octave bands when the effects of noise on man are being considered. The numerical values of his limits probably differ from those usually used in the Unted States, but this cannot be determined from the data in his paper. —H.O.P.

A Simple Method for Monaural Measurement of Perstimulatory and Post-stimulatory Auditory Fatigue (Eine einfache Methode zur monauralen Messung der perstimulatorischen und poststimulatorischen Adaptation oder Hörermüdung). H. Feldmann.* Arch. Ohren- Nasen- u. Kehlkopfh. 171:304, 1958. (*Vosstrasse 7, Heidelberg, Germany.)

If one presents a sustained tone to one ear of a normal person and periodically matches the loudness of this tone with another sound presented for short periods of time to the other ear, it is found that the loudness of the sustained tone gradually dcreases; this effect is called perstimulatory fatigue. Although decreased in loudness, however, the long-sustained tone does not lose any of its ability to mask a tone of different frequency presented to the same ear. A new observation that may eventually explain this somewhat puzzling situation is described in this article. The author shows that the intensity of white noise necessary to mask the sustained tone gradually decreases at approximately the same rate as the loudness is changing. In other words, as a steady tone continues, its susceptibility to masking *by* other sounds increases, although its ability to mask does not change. The clinical value of measurements of this effect are discussed. —W.D.W.

Studies on the Temporary Hearing Threshold Shift at Different Frequencies After Exposure to Various Octave Bands of Noise. B. Kylin.* Acta otolaryng. 50:531 (Nov.-Dec.) 1959. (*Nybodagatan 16, Solna, Sweden.)

Temporary threshold shift (TTS) following a two-hr. exposure to octave-band noise was measured after 15 min. of recovery. A total of 220 persons (all with normal hearing) was tested, 10 for each of 22 noises, as follows: 75-150 cps at 95, 100, 110, and 115 db SPL (sound-pressure levels); 150-300 cps at 90, 95, 100, and 105 db SPL; 600-1200 cps at 85, 90, 95, and 100 db SPL; 2400-4800 cps at 75, 80, 85, 90, and 95 db SPL; and 4800-10000 cps at 75, 80, 85, 90, and 95 db SPL. The results' showed that the TTS produced by a noise at a given level was greater for octave bands of higher frequency than for those of lower frequency. Similarly, a greater SPL was needed at low frequencies than at high frequencies in order to produce a given amount of TTS. For example, to produce 3.3 db of TTS (at test frequencies about one octave above the frequency of the noise band) required about 100 db of 75-150 cps or 150-300 cps, 90 db of 600-1200 cps, and only 82 db of 2400-4800 or 4800-10000 cps. It is pointed out that these values closely parallel the damage-risk criterion suggested by Hardy, a criterion based on the premise that octave-band noises of equal loudness are equally dangerous. —W.D.W.

About the Authors

WILLIAM F. ASHE, M.D., is author of the lead article in this issue, "Education for Industrial (Occupational) Medical Practice in the United States." He is the originator of the present system of graduate training in occupational medicine which utilizes two university years followed by service at an approved field facility for one year, introduced while he was Associate Professor of Industrial Medicine at the University of Cincinnati during the years, 1946-1950.

DR. ASHE briefly left the teaching field in 1950 to serve as Chief of Medical Service and Director of the Medical Division of the Holzer Hospital and Clinic at Gallipolis, Ohio. In 1954 he accepted his present appointment as Professor and Chairman, Department of Preventive Medicine, as well as Professor of Internal Medicine at The Ohio State University, Columbus. There he directs a graduate program of training for specialists in occupational medicine, aviation medicine, and nuclear medicine.

A graduate of Lake Forest (Illinois) Academy, DR. ASHE holds a baccalaureate degree in chemistry from Oberlin College. He received the M.D. degrce from Western Reserve University in 1935, and thereafter served an internship in internal medicine at Lakeside Hospital (Cleveland) and a residency in this specialty at the Cincinnati General Hospital. In 1940 he became a research associate in applied physiology at Kettering Laboratory and an instructor in internal medicine, at the University of Cincinnati.

During the war DR. ASHE served successively as Chief of Clinical Research Section, Armored Force Medical Research Laboratory at Fort Knox; Associate Director, Nutrition Division, Office of the Surgeon General (U. S. Army); and Director of Nutrition Surveys, Office of Military Government, at Frankfort and Berlin. He returned to the University of Cincinnati as Associate Professor of Industrial Medicine in 1946.

DR. ASHE is the author of a list of publications on various aspects of industrial medicine and toxicology, nutrition and general internal medicine, and medical education. He is certified in occupational medicine by the American Board of Preventive Medicine and is a member or fellow of the professional associations connected with this field, including IMA. He is consultant to several governmental health and defense agencies, and is at the time of writing directing the Nutrition Survey Mission in Chile.

PAUL J. WHITAKER, M.D., D.I.M., the son of a pioneer industrial medical director, was born and reared in a steel center, Wierton, W. Va. He attended the University of Pittsburgh, where he was elected to Alpha Omega Alpha honorary fraternity. He received the M.D. degree in 1939. After an internship at Mercy Hospital, Pittsburgh, he served a short residency in pathology and then entered the practice of internal medicine.

DR. WHITAKER was a flight surgeon in the Air Force and spent 33 months in the Pacific Theatre of Operations. He was discharged with the rank of major. Thereafter he engaged in graduate training at the University of Cincinnati, where he received the degree of Doctor of Industrial Medicine in 1951.

Upon completion of his training, DR. WHITAKER became Medical Director of Allis-Chalmers Manufacturing Company, Milwaukee, Wis. He serves also as Assistant Clinical Professor, Occupational and Environmental Medicine, Marquette University. He is Secretary of the American Academy of Occupational Medicine and was recently elected a director of the Industrial Medical Association. He is President-Elect of Central States Society of Industrial Medicine and Surgery.

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About the Authors

His article in this issue is "Graduate Training in Occupational Medicine—The In-Plant Component."

THEODORE F. HATCH, M.S., Professor of Industrial Health Engineering at the Graduate School of Public Health, University of Pittsburgh, is author of the article in this issue, "Training for Industrial Hygiene in the United States."

PROFESSOR HATCH has been a central figure in the development of the field of industrial hygiene. The chronological summary of his principal work situations indicates but meagerly the interests of his productive career: 1925-1926, Assistant Sanitary Engineer, Tennessee Health Department; 1926-1936, Instructor in Industrial Hygiene, Harvard University; 1936-1940, Chief Industrial Health Engineer, New York Department of Labor; 1940-1942, Associate Professor of Industrial Hygiene, University of Pennsylvania; 1942-1945, Research Executive (Lieut. Col. A.U.S.), Armored Medical Research Laboratory, Fort Knox; 1945-1949, Research Director, Industrial Hygiene Foundation; and since 1949, his present post at the University of Pittsburgh. During this time he has published well over 100 articles on various aspects of industrial hygiene, dusts, heat, engineering, analytical methods, and human engineering. He is co-author of the textbook "Industrial Dust." He serves widely as a consultant to industry and governmental bodies, and is Research Adviser to the Industrial Hygiene Foundation.

PROFESSOR HATCH has received a list of honors: scholastic, professional, and military. He is a past president of the American Industrial Hygiene Association, and he has been the Association's Cummings Memorial Lecturer. Perhaps as much as anyone in our generation he has been able to see and to lead, through the example of effective performance, the multidisciplinary approach to the man-work complex which is the crux of the occupational health endeavor.

DORIS B. YINGLING, R.N., Ed.D., is author of the article in this issue, "Educational Opportunities for Industrial Nurses."

DR. YINGLING received nurse's training at Union Memorial Hospital, Baltimore, Md., and thereafter continued in graduate education and teaching. She received the M.A. and the Ed.D. degrees from the University of Maryland. For a time she was Industrial Health Consultant in the Middle Atlantic Division of the Liberty Mutual Insurance Company.

DR. YINGLING has been active in a list of service functions with the National League for Nursing, the American Association of Industrial Nurses, the Industrial Nursing Institute of Catholic University, Maryland State Nurses' Association, the (Maryland) Governor's Conference on Health and Safety, and the Maryland State Health and Safety Conference. She is the author of several articles on nursing education and industrial health problems. She started the University of Nevada's first School of Nursing. She is now Dean, School of Nursing, Medical College of Virginia at Richmond.

DR. THOMAS G. RIGNEY received his M.D. degree from Cornell University Medical College in 1944. He interned at Bellevue Hospital, and after his return from service with the U. S. Army Medical Corps he served his residency at Lincoln Hospital, New York City. From 1950 to 1952 DR. RIGNEY was Director of the Kipsbay Cancer Detection Clinic and Director of Student Health Services, Cooper Union, New York City, and Director of the Employee Health Services at New York Hospital. He has served as an Instructor in Anatomy and as an Instructor in Public Health and Preventive Medicine at Cornell University Medical College. He is now an Instructor in the Department of Medicine at that school. DR. RIGNEY joined the Medical Department of the Standard Oil Company (New Jersey) in 1953, serving as Senior Physician until his appointment as Acting Assistant Director, Medical Research Division, Esso Research and Engineering Company, in March, 1960. In 1957 he was certified as a specialist in Occupational Medicine by the American Board of Preventive Medicine. He is a member of the American Medical Asso-

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ciation and Associate of the American College of Physicians. He is also a Fellow of the Industrial Medical Association, where he has served as Chairman of the Public Relations Committee for the past three years. He is senior author of the article in this issue, "Research in Occupational Medicine in the United States."

DR. ROBERT E. ECKARDT received his Ph.D. in biochemistry from Western Reserve University in 1940, having performed his research in the field of vitamins. He then received his M.D. degree from Western Reserve University in 1943, after receipt of which he served his internship and assistant residency in medicine at New York Hospital until 1944, when he entered military service. He was separated from the service with the rank of Major in 1947 and completed his residency and training at New York Hospital. He joined Standard Oil Company (New Jersey) as a special clinical research physician in June, 1948, and in 1951 was appointed the first Director of the Medical Research Division of Esso Research and Engineering Company, a position which he still holds.

DR. ECKARDT was certified by the American Board of Internal Medicine and by the Founders' Group of the American Board of Preventive Medicine (Occupational Medicine) in 1955. He is a Fellow of the American College of Physicians, a member of the American Medical Association, a Fellow of the New York Academy of Medicine, a Fellow of the American Academy of Occupational Medicine, and a member of the New York Academy of Sciences and the New Jersey Academy of Medicine. Dr. Eckardt is president of the Industrial Medical Association. He is co-author of the article in this issue, "Research in Occupational Medicine in the United States."

MARIO C. BATTIGELLI, M.D., M.P.H., is a member of the faculty of the Department of Occupational Health in the Graduate School of Public Health, the University of Pittsburgh.

A native of Italy, DR. BATTIGELLI graduated in medicine and surgery from the University of Florence in 1951. He thereafter became clinical assistant at the Clinica del Lavoro, Milan, where he worked in internal medicine and gained an extensive experience in the clinical aspects of occupational disease. He passed the examinations of the Specialty Board of Occupational Medicine given by the University of Milan in 1954 cum laude. He won a scholarship for specialization in occupational medicine in a foreign country, and came to this country in 1956 as a resident in internal medicine at St. Francis Hospital (Pittsburgh) and a graduate student in occupational medicine at the University of Pittsburgh. He joined the faculty in the fall of 1958.

DR. BATTIGELLI is the author of more than 20 published articles on the biochemical, toxicological, and clinical aspects of occupational disease, published in the Italian literature. He is a literature abstracter for the JOURNAL OF OCCUPATIONAL MEDICINE. His contribution to our present issue is the first part of a topical review, "Mercury Toxicity from Industrial Exposure."

—EDITOR

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People and Events

► D. JOHN LAUER, M.D., became Medical Director for the International Telephone and Telegraph Corporation on June 1. He is now located in New York City, having moved from Pittsburgh where he had held the position of Medical Director for Jones & Laughlin Steel Corporation since 1951.

DR. LAUER received his medical degree from the University of Minnesota in 1938 and interned at St. Mary's Hospital in Duluth, Minn. He was in general practice in St. Paul for the next two years. From 1940 to 1946 he served with the Medical Corps of the U.S. Navy. He held the rank of Commander at the time of his discharge from active duty.

From 1946 to 1947 he was a Fellow in Industrial Medicine in the Department of Industrial Hygiene, University of Pittsburgh, School of Medicine. He received the Doctor of Industrial Medicine degree from the University of Pittsburgh in 1950. He then moved to Cincinnati where he provided industrial medical services for small industries and was Assistant Professor of Industrial Medicine at the University of Cincinnati.

DR. LAUER is the immediate past president of the Industrial Medical Association, and of its Pittsburgh Component Society. He is a member of the American Industrial Hygiene Association, a Fellow and former director of the American Academy of Occupational Medicine and a Fellow of the American Public Health Association. He is a Diplomate of the American Board of Preventive Medicine, certified in the specialty of Occupational Medicine.

DR. LAUER was Associate Clinical Professor of Industrial Medicine at the University of Pittsburgh and played a prominent part in the community's growing interest in industrial health. He was chairman of the Board of Health of Allegheny County and a member of the Advisory Health Board of the Commonwealth of Pennsylvania.

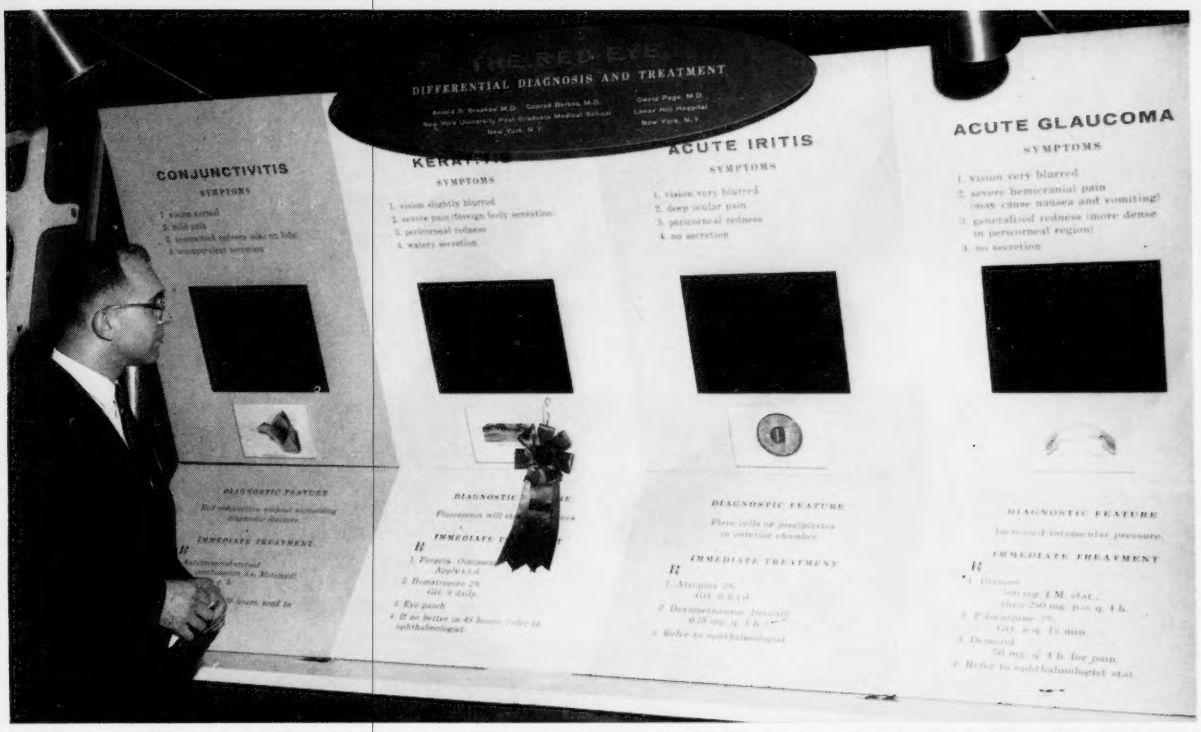
► ROBERT J. HALEN, M.D., became Medical Director for Jones & Laughlin Steel Corporation on June 1, succeeding D. JOHN LAUER, M.D.

Robert J. Halen, M.D.

DR. HALEN became Works Physician for the Monongahela Connecting Railroad, a J & L subsidiary, in 1953, and in 1958 was appointed Works Physician at the Corporation's Pittsburgh Works. He received his M.D. degree from the University of Pittsburgh in 1948 and served his internship at Walter Reed Hospital in Washington, D.C. He spent the next three years in the Medical Corps of the U.S. Army, then returned to the University of Pittsburgh to earn a Master of Public Health degree in Occupational Medicine. He now serves as Clinical Associate in Occupational Health in the University's Graduate School of Public Health. He is a member of the Industrial Medical Association, and is a Diplomate of the American Board of Preventive Medicine, certified in the specialty of Occupational Medicine.

► Northwest Association of Occupational Medicine held its spring meeting at the Boeing Airplane Company Missile Production Center in Seattle, Wash., on June 11. The morning session, which was devoted to the subject of space medicine, was presented by ROMNEY LOWRY, M.D., Manager of Boeing's Space Medicine Section, and his staff. The following presentations were included in this session: "Closed Ecological Systems" by DR. ARTHUR

The British Columbia Electric Company recently became the second industry in the province to receive the Occupational Health Institute's Certificate of Health Maintenance. The certificate was presented at a luncheon meeting held during the third annual Occupational Health Conference in Vancouver. Russell G. Birrell, M.D., left, made the presentation to the company's Vice-President, Harry Purdy, center. John Nelson, M.D., Medical Director, receives congratulations from Dr. Birrell.



The prize-winning scientific exhibit at the 1960 Industrial Health Conference, held in Rochester, N.Y., April 26 to 29, is pictured above. The exhibit, entitled "The Red Eye—Differential Diagnosis and Treatment" was prepared by Arnold S. Breakey, M.D., and Conrad Berens, M.D., Lenox Hill Hospital, New York, N.Y.

J. PILGRIM; "Instrumentation of Man for Space" by DR. HERBERT MEGEL; "Cabin Environment: Toxicity Control" by DR. F. WERNER, JR.

The afternoon session, which was devoted to a consideration of the industrial health problems of jet aircraft, included the following presentations by Boeing personnel: "Dermatitis Problems with Hydraulic Oils" by FRANZ BARTL, M.D., and GENE TRUCANO, Industrial Hygiene Engineer; "Radiation Contamination" by WILLIAM MORGAN, Radiation Hygienist; "Sanitation Problems" by JOHN JOHANSON, Industrial Sanitarian; "Ground Crew Problems — Fuel Cells, Noise" by WALTER POPPE, JR., Chief Industrial Hygiene Engineer, and FRANZ BARTL, M.D.

► The Fifth Annual Industrial Health Symposium, sponsored by the Industrial Health Committee of the Colorado State Medical Society, was held May 18 at The Martin Company's Missile Plant in Denver. The program included the following presentations: "Nurses in Industry," a panel discussion by BEVERLY BLACK, R.N., GEORGE J. MARESH, M.D., and LAWRENCE M. WOOD, Attorney; "Challenges in Space Medicine" by JAMES G. GAUME, M.D.; "Non-Occupational Absenteeism" by ROBERT F. BELL, M.D.; "Traumatic Neuroses" by EDWARD G. BILLINGS, M.D.; "Organization of Industrial Health Departments and Their Functions" by W. GRAYBURN DAVIS, M.D.; "Eye Injuries in Industry" by MAX KAPLAN, M.D.

► Kentucky Industrial Medical Association elected new officers and directors at its spring meeting on April 7 as follows: President—EUGENE H. KREMER, JR., M.D.; President-Elect—CHARLES F. MARTIN, M.D.; Vice-President—CHARLES E. ALLEN, JR., M.D.; Secretary-Treasurer—DONALD B. THURBER, M.D.; directors—GRADIE R. ROWNTREE, M.D. (past president), R. E. DOUGHTY, M.D., WALTER L. O'NAN, M.D., and ARTHUR J. SHULTHISE, M.D.

► Michigan Industrial Medical Association has recently elected the following new officers and directors: President—DUANE L. BLOCK, M.D.; President-Elect—RICHARD D. MUDD, M.D.; Vice-President—WILLIAM JEND, JR., M.D.; Secretary-Treasurer—ROBERT D. MCINTOSH, M.D.; directors—HAROLD H. GAY, M.D., PETER B. RASTELLO, M.D., M. W. SHELLMAN, M.D., and OTTO J. PRESTON, M.D.

► Western New York Society of Industrial Medicine and Surgery held its spring meeting on June 4 at the Treadway Otesaga in Cooperstown, New York. Featured on the scientific program was an address by GORDON SIGEL, M.D., of the U.S. Public Health Service, who is also associated with the Syracuse Public Health Department. His subject was "A Study of Forty Industrial Companies in Syracuse with Reference to their Usage and Needs with Regard to Industrial Medicine."

► Hawaii Association of Plantation Physicians will hold its annual meeting in Honolulu on October 6, 7 and 8, which will be immediately after the Pan Pacific Surgical Association meeting.

Paper Clip Flipping—An Occupational Hazard

The following story by Warren Weaver, Jr., appeared on page one of the New York Times, *April 29, 1960.*

Shooting paper clips out of an office window with a rubber band can be properly considered associated with the job of an otherwise unoccupied messenger boy, the Court of Appeals held today.

The court declined to set aside a workmen's compensation award of $228.64 to James Johnston, a Staten Island messenger boy, for injuries he suffered when just such a paper clip backfired and caught him in the eye.

In 1955 Mr. Johnston, then 17 years old, was sitting on a bench in a New York City office building, awaiting messenger duty and idly flipping paper clips out of the window. The Workmen's Compensation Board decided that his activity had been sufficiently close to the regular course of his employment to make the injury he suffered compensable under state law.

The boy's employer, Lowe's Incorporated, went to court to get the award reversed. But the Appellate Division, Third Department, decided by a 3-2 vote that rubber band slingshots were part of the standard equipment of a waiting messenger.

The Appellate Division observed then that the courts should use "some considerable latitude and freedom" in judging what was and what was not within the course of employment of a messenger boy, "in recognition of their youth and restlessness."

The intermediate court determined that such an accident could not be flatly classed as skylarking and thus not compensable because it involved the use of rubber bands and paper clips.

"The act and the instrument, when conjoined to cause the injury, have a somewhat closer relationship to the employment than those in the ordinary case involving horseplay," the Appellate Division declared.

The Court of Appeals affirmed the appellate division decision by a 5-1 vote but did not offer any opinion of its own.

The sole dissenter was Associate Judge John Van Voorhis, who wanted to reverse the compensation award "upon the ground that it is not supported by substantial evidence."

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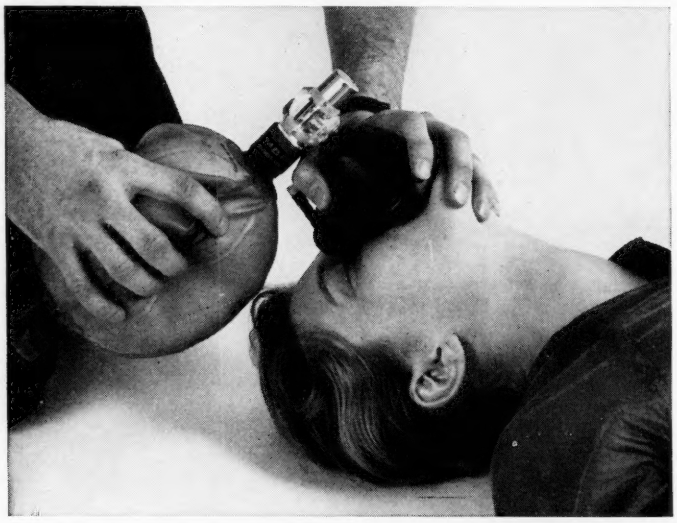

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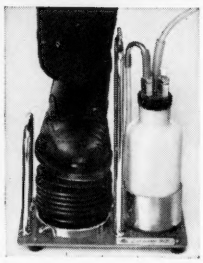

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